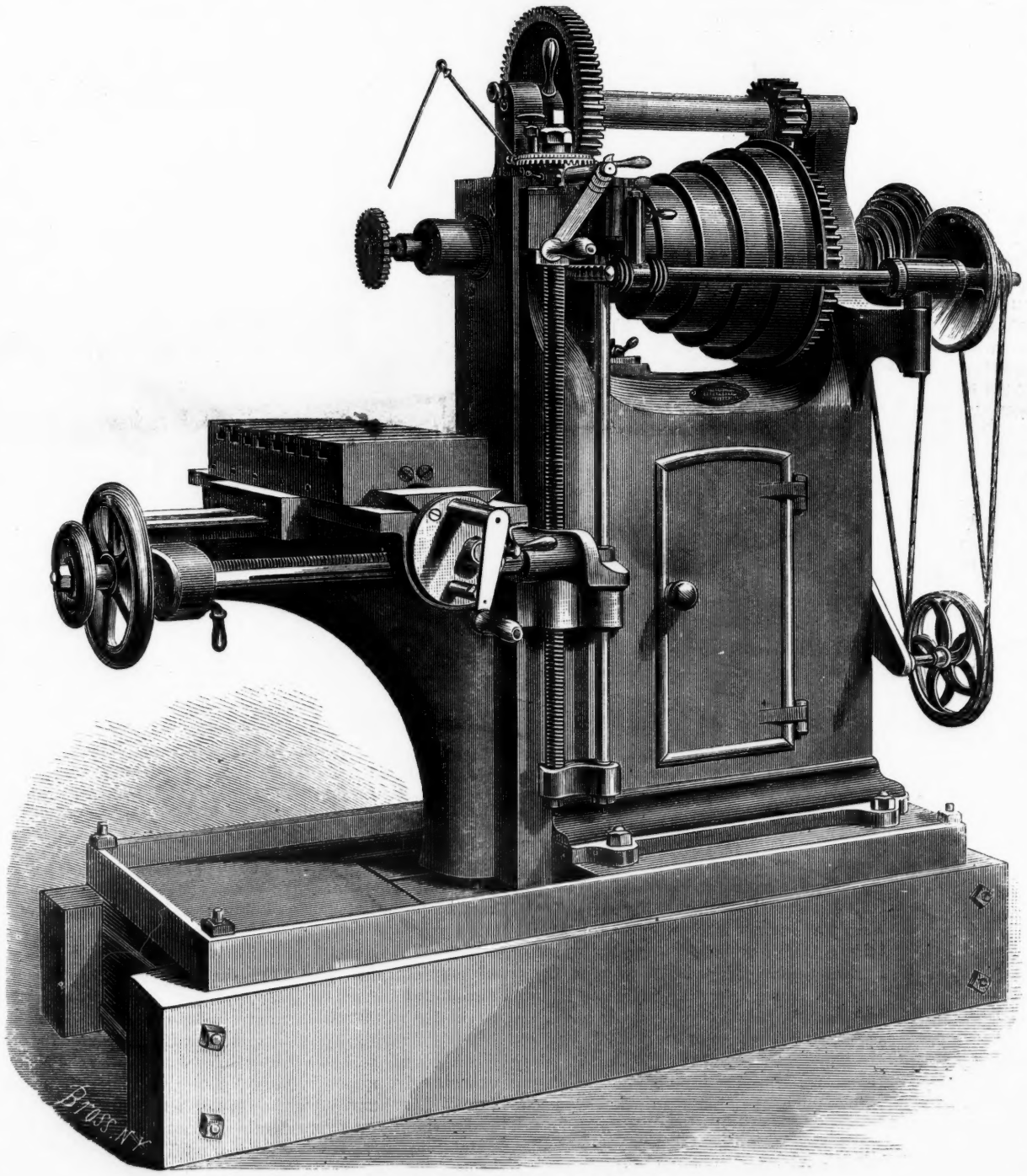
AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 2, No. 4.] NEW YORK, FEBRUARY, 1879. [$1.00 per Annum.
SINGLE COPIES, 8 CENTS.

New Universal Milling Machine.

The milling machine occupies the same relation to metal that the planing and molding machines do to wood. In each case the work is reduced by a rotary cutter, whether the surface be plain or irregular. Milling machines, which have advanced greatly in the past ten years, are now used as finishing tools in machine shops, particularly in reducing to shape the forged, stamped, or cast pieces which are made in large numbers, to an exact gauge, and afterwards built up into sewing-machines, fire-arms, and other machines constructed by duplication of parts. They are also largely used for finishing heads of bolts and set screws, shaping nuts, fluting taps or reamers, and cutting key-seats. The milling machine is the legitimate offspring of the gear cutter which was known and used in Europe as early as the sixteenth century, and which, with its rotary cutter and slides, performed, in a less and inferior degree, the work of our present perfected milling machines. The accompanying illustration represents Krutzsch's Universal Milling Machine, which the manufacturers claim to be the most complete, symmetrical and substantial machine made for this purpose, and one which for reliability of work, strength and adaptability of parts, and ease with which it can be manipulated, takes superior rank. It is claimed to have a much wider range than any other machine now in use, and can first make the tools with which it works the most irregular and complicated shapes, with a facility which is surprising. Among the notable characteristics of this machine are the strength of its frame, saddle and table, which are capable of sustaining and carrying very heavy pieces of work, ranging in weight from fifteen hundred to two thousand lbs.



NEW UNIVERSAL MILLING MACHINE.

Its perpendicular range is 19 inches, the length of cross feed 26 inches, and the feed parallel to the spindle 14 inches. It swings 53 inches clear of the saddle on the spindle, and the latter is provided with a screw the same as in a lathe and the driving cone is connected with a full gearing which gives twelve speeds, and allows mills of every size. The fast speed is necessary for cutting wood gear patterns, which can be cut to any diameter needed.

The tool spindle will claim attention from its positive improvements and special advantages, being hollow throughout, as usual, to receive the screw which fastens the cutters. It has for front-bearing a cone shaped anti-friction seat in the upright slide bar, having the advantage of a larger straight bearing with less friction. The reverse end or rear-bearing is provided with a taper collar, fitting a corresponding opening in the head with thread outside. This collar is slotted longitudinally, so that by screwing the nuts upon each end, the collar may be made to fit tight or loose upon the spindle, regulated by jam nuts, thus making it a self-adjusting bearing, always perfectly stiff and firm.

It will be noticed that the movements of the tables are of unusual length, and these movements may be made by hand or automatically by the machine—each independent of the other, or combined without interference; and by an ingenious arrangement of a wheel and worm the feed may be instantly and noiselessly reversed from right to left. The feeding mechanism is housed, and all the handles for operating the parts are within easy reach of the attendant. Any desired pitch of feed may be easily arranged by the speeds of the pulley on the rear of the machine.

The main frame with its upright slide bar and all the bearings are cast in one piece, which is screwed to a base, the upper half of which forms a pan. On the under side is cast a tank, into which reaches the upright slide bar, allowing the slides to be lowered more than in any other similar machines.

It is therefore capable of being converted into a lathe, which will swing 53 inches on its face, and all its slides can be used with its automatic feed, thus rendering it well adapted to turning wooden patterns.

Another peculiarity is an upright screw-shaft, working in bearing blocks, extending laterally and supported on a main frame provided with an index wheel with graduated scale and stationary pointer, so that the tables may be raised or lowered to any extent desired, ascertainable from the index with perfect exactness.

Another unique arrangement is a rotary pump placed in a reservoir in base of frame, driven by a shaft, provided with a friction roller, which is actuated by a disk upon the drawing pulley. The roller sliding in bearings and connected at pleasure, is made to force water through a pipe to a jointed nozzle, its flow directed upon the work or back into the tank by way of a two-way valve. These and other essential improvements, are features of the tool itself, divested of its attachments.

The latter are as follows:

1st. A center head with universal index for gear cutting, for cams, twist drills, worms, reamers and taps.

2nd. A cross-cut head for racks, cutting bars, etc.

3rd. A chuck for nuts and screw heads.

4th. A spiral attachment for twist drills, spiral reamers, and milling screws.

5th. A turn table for milling circles and gear cutting.

6th. A very substantial vise, and many other arrangements for special work, as supporting arm to convert the machine into a horizontal boring mill.

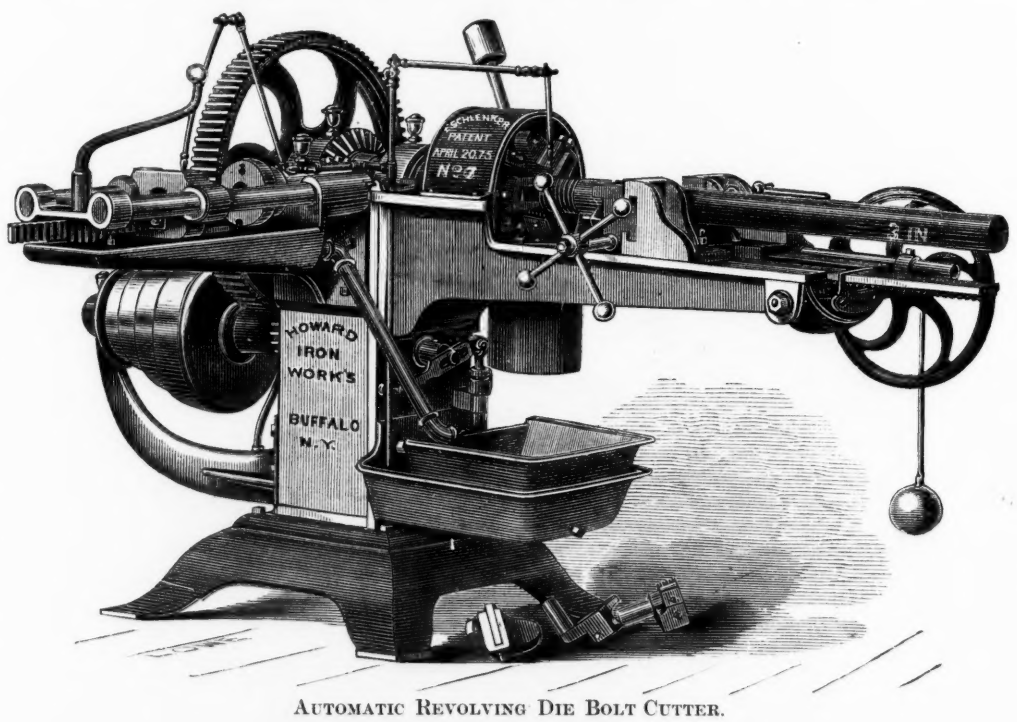
The main slide table moving at right angles with spindle, and upon which the work is secured to easily overcome any wear a half nut, made of the best steel in two sections, is inserted longitudinally on the underside, working into the screw held in position by set screws at each end of the slide, so that in case of wear the back lash may be taken up on either, or both.

For further information and particulars, address The Buckeye Iron and Brass Works, Dayton, O., who are the builders of this substantial and most useful tool.

The most fatal disease that threatens the vitality of many of our oldest and largest machine establishments is *Conservatism*. When a concern settles down to running on its accumulated reputation without an effort to improve its patterns, processes or style of work, the disease will surely enfeeble it, while its enterprising rivals push ahead, until the crisis approaches and it is forced to cry "help me Cassius or I sink."

Automatic Revolving-Die Bolt Cutter.

The characteristic of our American mechanical productions which have gained marked superiority over those of Europe, are largely due to the use of *Special Automatic* machinery. In this class we find bolt cutting and nut tapping machinery receiving great attention from our best mechanics. In times like these when the demand for bolts and nuts is not so great as to keep prices where, with facilities heretofore unsurpassed, broad margins of profit can be maintained by manufacturers, it becomes an important economic question how to produce them cheaply and of a satisfactory character. As but little can be saved in the purchase of iron, the answer to this question must be found in machinery that will turn them out with the greatest *rapidity* and *reliability*. In this respect the machine herewith illustrated offers strong claims to possess many advantages over any competitor. The dies are opened *automatically* when the desired length of thread has been cut on the bolt and are closed by the lever as shown in the cut which represents Schlenker's Automatic Revolving-Die Bolt Cutter with nut-tapping combination. It can be changed from one size to another in less than a minute. It does not require skilled labor, but can be run by a boy. This machine is claimed to cut threads on bolts more rapidly than any other —at least *twice the number* in the same time than any other machine will cut. In construction it is simple, compact and strong, and in price is offered as much lower than any other that will cut the same sizes and amount of work. It will cut square threads, coach screws and a V thread, and will take in crooked as well as straight work. Parties requiring bolts of different sizes find this machine specially adapted to their use, will cut threads on bolts and tap nuts from $\frac{3}{8}$ to 3 inches inclusive. 18 sets of steel chucks with dies and 18 master taps are furnished with each machine of the kind illustrated, also 18 nut taps at moderate extra expense. This machine has powerful back gear with seven different speeds and is supplied with lubricating pump. It has a nut tapping combination giving virtually two machines in one, which enables the operator to tap nuts from $\frac{3}{8}$ to $1\frac{1}{4}$ inches inclusive, at the same time the thread is being cut on the bolts. This effects a large saving of time. Nuts for bolts larger than $1\frac{1}{4}$ inches in diameter are cut on the main spindle, and all the necessary apparatus is furnished with the machines. As to power and capacity, this machine has received the highest encomiums from parties who have it in use. The Howard Iron Works, Buffalo, N. Y., manufacture this machine also others of the same kind, of smaller capacity without nut tapping arrangement. They have for years had a high reputation for making bolt cutters and the new style is offered as being far superior to any before produced.



Automatic Revolving Die Bolt Cutter.

Engineering Popularized.

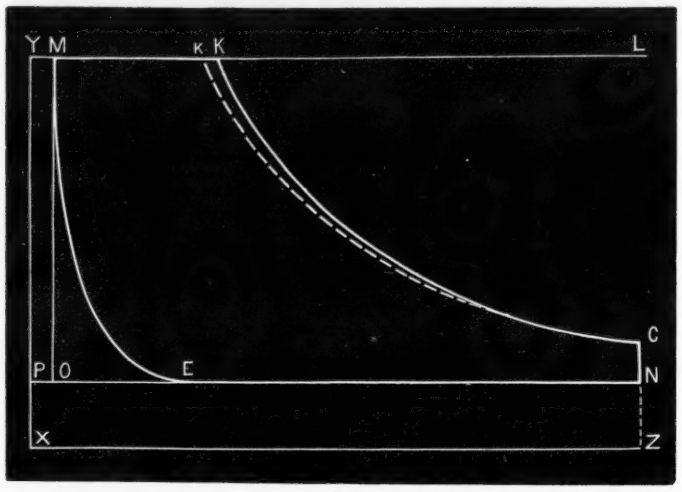
(No. II.)

It happens, Messrs. Editors, that my friend Odell's article in your last falls very pat with the line of discussion I am proposing. In it he very properly considers the complete idea,—which is really *the* idea after all, by the test of dollars and cents—that of the combined duty or efficiency of the whole plant; engine, boiler, steam pipe and all. For really, every item from the knob on the fire door to the last belt lacing, has a chance to rob the manufacturer's pocket. His fireman at stated periods shovels some money into the furnace. (That the money happens to look like coal in this instance, is of no sort of consequence.) Well, a gust whirls a good part of it—the paper money, I suppose,—up the chimney and it is gone. Some of the loose change soaks into the fire walls. Some is lucky enough to get taken up by the steam, to be sure, but every joint and elbow and valve (especially governor valves) choke and hinder it on its way to the engine. A steady stream of it puffs and drizzles from the exhaust pipe. Odd coppers are to be found scattered around every bearing, and it is only a sorry remnant of shin plasters that at last rolls off on the main belt,—not over a dime to the dollar. Now if some optical instrument,—say leather spectacles, would show all this smoke, drizzle, and puff in the true form of tangible greenbacks, how radical would be the reformation! As it is, they shovel in the money, the shaft goes round and they are happy. Now it is quite possible to arraign every member of the plant and convict it of criminal wastefulness in the 1st, 2d or 3d degree. While I fully endorse Mr. Odell in admitting that the diagram in no wise shows what power we *shall* get for our money, it empathically shows us what we are *entitled* to get. It has nothing to do with circumstances behind the engine; —it is a merciless critic of the engine itself. Our purpose now is to waive the boiler question entirely; or rather, assuming a perfect equality of conditions in all cases as far as the stop valve, to try the engine on its own responsibility.

Suppose now, I were a manufacturer about to purchase an engine. I open the job to competition by the leading builders, stating the amount of power required. Each competitor designs and erects his engine to suit himself, and all connect to the same boiler, fired from the same coal heap, by the same fireman. I run each engine a month, note the coal consumed, and production got off, and am not long in deciding, other things being equal, which engine to pay for. This plan—more's the pity—is not practicable, but I assert and am prepared to maintain that the testimony of the indicator is just as impartial and reliable *as regards the merits of the engine itself*, as the other more obvious plan.

I come now to enunciate the proposition:—

THE MEASURE OF THE INTRINSIC ECONOMIC VALUE OF A STEAM ENGINE IS ITS DYNAMIC EFFICIENCY IN TERMS OF THE ADIABATIC CURVE. Well, that sounds a little abstruse I admit, but we will soon clear it up. Let me at once strongly impress this corollary,—that the whole science of steam economy is concentrated in one plain statement, viz:—*the mean effective pressure* (*i. e.* the average vertical width of the diagram by scale) *is the measure of the value of the power, and the absolute terminal pressure, from vacuum, is the measure of the cost of that power.* It is now obvious that the more pressure, *i. e.* the larger card, we get for a given terminal pressure, the more goods we get for our money, with one qualification. The first inquiry then is: what is the largest card that can be described, theoretically, from a given terminal pressure Z C? Such a card would be a proper standard. Suppose an engine whose steam pipe and ports were so very large and so very short that inappreciable resistance occurred to the passage of the steam. We have heretofore been erroneously taught as follows: A certain amount of steam at full boiler pressure O M is admitted until the piston has moved to the point k, at which point the valve instantly closes, when the pressure falls just in proportion as the piston moves, (Mariotte's Law) forming the hyperbolic curve k C until the end of the stroke C, at which point the exhaust valve opens and the remaining pressure Z C is thrown away. On the return stroke the piston moves freely without encountering any apparent resistance until the beginning of the stroke, when the full pressure O M is admitted as before. We are now told that the area M k C N O represents the most perfect ideal performance of the steam, and we naturally infer that in an engine making such a diagram we should realize the highest attainable economy. On the contrary this is all wrong, and I may assert that if such a card were described by any engine now made, we should find results on the coal pile quite materially short of what might be secured.



The true standard—the unit of perfect efficiency is the heavy line diagram M K C N E, and it is formed as follows: The lines M K, C N, and N E, are all right, showing respectively a pressure of admission equal to that in the boiler, instantaneous exhaust, and a counter pressure equal to zero,—obviously limiting conditions The limiting expansion curve, representing the theory most unaffected by circumstances, is the adiabatic curve. The theoretical conditions for its formation are: dry but not super-heated steam, absolutely tight valves and piston, and an absolutely non-conducting material for all parts of the cylinder in contact with the steam. That is, the steam once admitted is made to act on its own responsibility, without the addition of heat from any outside sources, as entrained water, leakages, or the hot metal of the cylinder. The resulting curve is the "curve of no transmission," which is the meaning of "adiabatic." Leaving for the present the discussion of this curve, we will agree that since it represents purely theoretical conditions, it may be approached in practice but never exceeded, and is hence a proper standard. It has indeed been taught that it can not be equalled, but the recent and repeated performances of the most modern and improved cut-off engines demonstrate to the contrary The hyperbolic or "isothermal" curve k C has even been considered beyond attainment, and has long been used as the standard of correct expansion, but since it has been exceeded it is no longer a proper standard, and we are compelled to fall back on the adiabatic curve, or submit to a basis of measurement analogous to the absurd zero of the Fahrenheit scale. It is, however, quite probable that the hyperbolic curve, from the greater ease with which it may be laid out, will still continue to be used, and so long as we get a good idea of their relative proportions, the inaccuracy is not material for practical purposes. In another paper we shall see how each curve may be simply drawn, and it only remains to note that for a given terminal pressure Z C—*i. e.* for a given *cost*,—we get the largest mean effective pressure (abbreviated, *m.e.p.*) and hence the largest area of work from the adiabatic curve, as may be seen from the Fig. in which K C is the adiabatic, and k C the isothermal curve. It is proper then to consider this curve as the standard of expansion.

The remaining line of the diagram E M is the compression line, and we now come to the qualification above alluded to. From the principle above noted, it would seem as if we should secure the highest efficiency in an engine having no compression, and showing a square heel to the card as E O M, since for a given terminal the card shows a larger area. Not so, however. If we could imagine an engine in which the piston at the end of the stroke, absolutely touched the cylinder head and valve faces, leaving no waste space or "clearance" whatsoever, then so far as economy is concerned no compression would be necessary, and a square heeled card would be admissable. Under these circumstances it is evident that the exhaust steam would be completely expelled to the last particle:—no steam could enter till the piston commenced to move, and *all* the steam admitted would therefore result in work. Suppose, on the contrary, that the piston can only approach within an inch of the cylinder head, represented by the distance O P. At the instant of admission this space is filled with exhaust steam at atmospheric pressure, and were it not for the fly wheel, the entering steam would have to fill all this space before the piston would commence to move, and an unnecessary consumption would ensue. And we have the still more detrimental fact that the metal of the cylinder, which has been greatly cooled by the previous exhaust, must be *reheated*, also at the expense of the entering steam. The remedy is compression, to attain which we provide that the exhaust valve shall close at some point E short of the full stroke, thus imprisoning a certain quantity of exhaust steam, the heat of which, instead of escaping to waste, is *squeezed out* and taken up by the cylinder surfaces until they are heated up

again. The clearance space is, moreover, filled with the exhaust steam, compressed to boiler pressure, so that the entering steam finds the waste room already occupied by steam of its own value, and hence it wastes no time or energy, but proceeds at once to move the piston. It is evident then that to prevent waste, the exhaust steam should be compressed up to full initial pressure just at the instant the valve opens, and hence the point of exhaust closure would seem to be easily determined by making the volume E P of the cylinder, at closure, as many times the clearance volume O P as the absolute initial pressure X Y is greater than the atmospheric pressure X P; say 15 lbs., (or back pressure, if any exists). Thus, in an engine worked at 75 lbs., with 1 inch total clearance. we should apparently close at 5 inches, in order that the imprisoned steam, when compressed to 1-5th its volume, should show 5x15=75 lbs. pressure. This is near enough for all practical purposes, but is not strictly true, since the cylinder walls abstract some of the heat during compression, thus causing the pressure to fall short, and to determine the actual point of closure required we are compelled to fall back on the diagram. When *that* shows a compression to the full initial pressure, or "initial compression," as I shall hereafter call it, we may be sure we have got all the value there is in it. To be sure compression is at a sacrifice of power, but the saving of heat and steam is greater than the loss of power, and it is *net* economic efficiency that we are after.

Now, Messrs. Editors, when I promise that I will quit right here, you will forgive the following very unscientific description of the perfect card, the standard of cylinder efficiency. The perfect card is bounded —on the north by boiler pressure,—on the east by the adiabatic curve and complete exhaust,— on the south by the atmosphere,—and on the west by initial compression.

I dare say no more.

WM. LEE CHURCH.

Niles Pulley Borer.

In our issue of last June we illustrated a Special Pulley Turning Lathe, built by the Niles Tool Works, Hamilton, Ohio, possessing points of novelty and great utility; we now present to our readers a companion machine designed to bore pulleys, nuts, couplings, gears, and the vast variety of such pieces, not exceeding 52 inches diameter, required in a machine shop.

In contrast with the ability of the ordinary lathe to accomplish this work, the Niles Pulley Borer is immeasurably superior; with the system of standard cutters, accuracy of size and rapid execution are both acquired to such a degree that 50 to 75 standard holes can be bored in pulleys or gear hubs, about 4 inches deep, in 10 hours time.

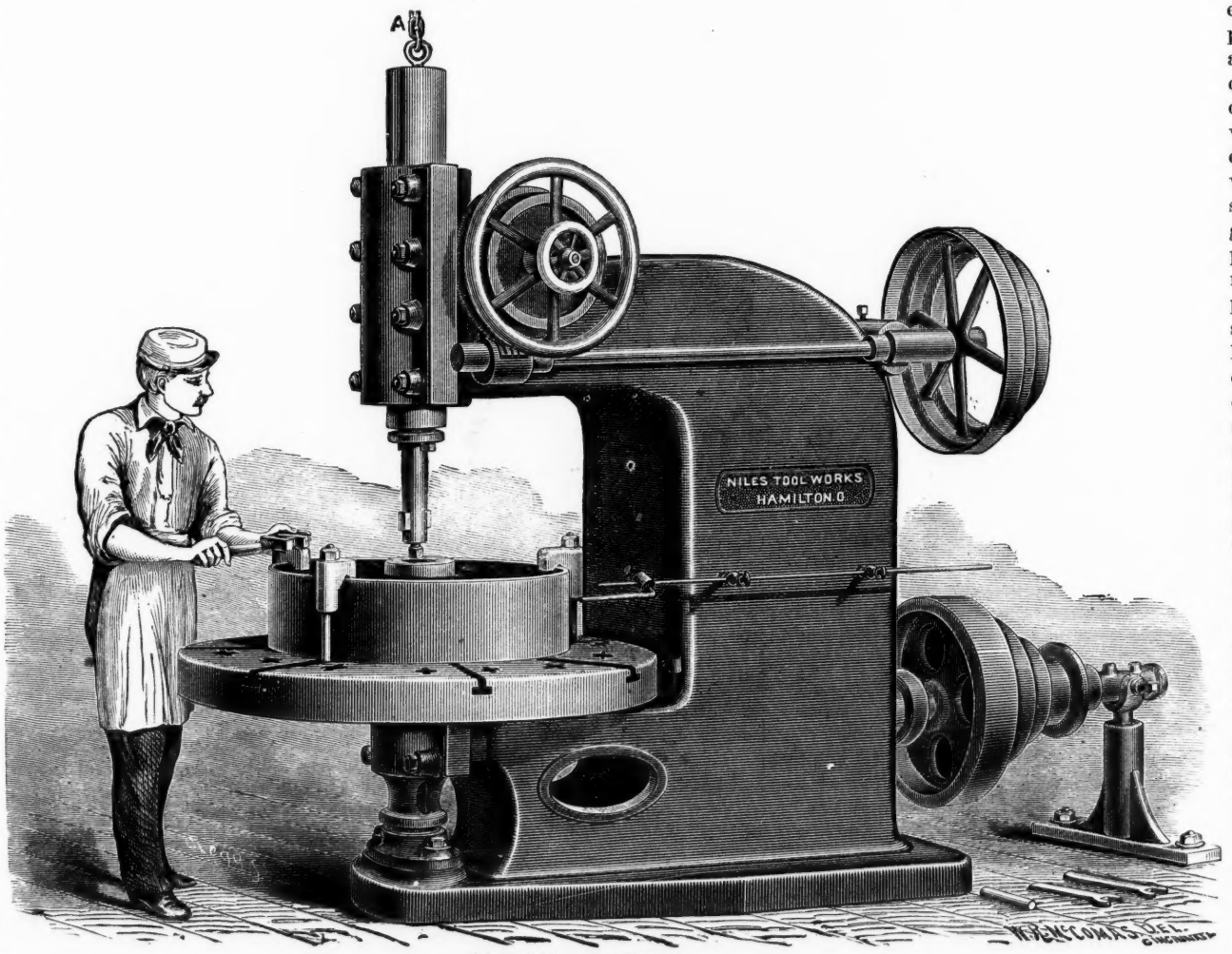
Comparatively unskilled labor can do this work, the processes are so simple that there is no liability of mistakes occurring; the cutters have the sizes stamped on them, and are quickly inserted in the tool bar as required; these cutters are very cheaply made, they being only cut from a bar of $\frac{5}{16}$th inch flat steel, and having no finish beyond their cutting edges. Other features in this tool, contributing to lessen the cost of the work it performs, are the horizontal chucking plate which has concentric circles cut on its surface, each one marked the distance from the center at four points, and the peculiar fastening appliances, which are chuck jams, in addition to hooks as shown; there is also an adjustable rest furnished to facilitate the operation of setting. The face-plate is revolved by powerful gearing driven by a cone with 4 steps for a belt 4 inches wide.

The tool bar is fed automatically; it is counter-balanced and has quick return hand movement.

The feeds are engaged and disengaged instantly; they are actuated by belt and worm gearing, rack and pinion all cut.

The countershaft is provided with tight and loose pulleys, 24 inches diameter, for a belt 4 inches wide, and should run 70 revolutions per minute, giving the chuck plate speeds as follows: 63, 43, 19 and 10 revolutions per minute, thus adapting the machine to bore holes from 1 to 7½ inches diameter; when operating on the latter diameter the power exerted on the cutting point is 1800 pounds.

This machine, taken in conjunction with the Special Pulley Turning and Polishing Lathe, form the best outfit for finishing pulleys of which we have any knowledge.



NILES' PULLEY BORER.

Economy and Waste in the Marine, or Condensing Steam Engine.

BY STEPHEN ROPER, ENGINEER.

The economy of the condensing over the non-condensing engine is due to the fact, that when the resistance of the atmosphere is removed from the piston, the steam may be cut off earlier, and further expanded in the cylinder. This reduces the draft on the boiler, and admits of a slower combustion of fuel. In this way economy is promoted by condensation of the exhaust steam, and by the vacuum formed in the cylinder. A vacuum equal to 14 lbs. per square inch, would be equal to a saving of 35 per cent. in fuel, or the same increase in power; but such a vacuum is hardly ever attained, even with the most perfect machinery, and when produced, can not be maintained for any considerable time, but this saving undergoes a great reduction, in consequence of the cylinder being open alternately to the lower temperature in the condenser, which varies with the degree of expansion employed; being least when the steam follows full stroke, which is very seldom the case. The practical gain therefore in the condensing engine is from 20 to 30 per cent., varying with the conditions above-named. The economy of the condensing engine might be increased, if advantage could be taken (as in the case of the injector and steam jet) of the velocity with which the exhaust steam escapes from the cylinder to the condenser. On entering the condenser the power due to its energy is entirely destroyed by the cold water injection, or by being brought in contact with refrigerating surfaces.

According to the dynamic theory of heat, a certain weight of coal contains within itself a certain amount of work stored up, and ready to rush out under the necessary surroundings, as in the case of a compressed spring set free. The supply of a given weight of coal to the furnace of a steam boiler represents the application of a definite amount of force at one end of a series of transformations, a part of which force at length appears as useful work at the other, the balance having been wasted in the different processes through which it has passed. Take, for *example*, a modern marine engine of the best construction and design. The force supplied to the furnace in the combustible is first developed as heat, by the burning of the coal; a portion of this heat is utilized in changing the water into steam, the balance being wasted, either in radiation, or by being carried off in the form of hot gases through the chimney. A part of the steam formed is applied to move the piston, the balance being wasted by condensation against the sides of the pipes, and cylinder, and by leakage past the piston or valves into the condenser.

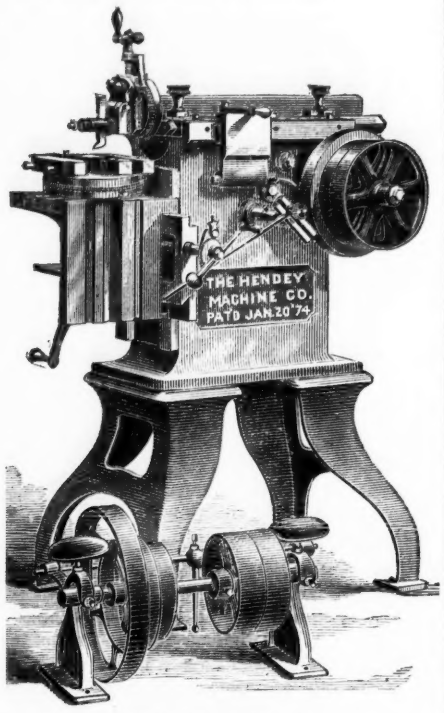
Only a small portion of the total force contained in the steam, that is applied to move the piston, is utilized, the balance escaping with the exhaust steam into the condenser. Of the force that is utilized in the cylinder only a small portion performs any external work, the balance being absorbed in over-coming the back pressure induced by the friction of the machinery itself. Of the remaining small portion that may be applied to the screw or paddle wheel, another part is wasted in overcoming its useless resistances, and only the balance is used to propel the ship or perform work.

The following figures represent approximately the supposed distribution of the total force in the best specimens:—

		Per Ct.
Total heat in 100 lbs. of good Anthracite coal in "units"	1,400,000	
Deduct heat equivalent to weight of ashes	200,000	
Total heat in 100 lbs. of Anthracite coal.	1,200,000	100
Carried off by hot gases in chimney	200,000	16⅔
Available to produce steam	1,000,000	83⅓
Lost by leakage and condensation	200.000	16⅔
Available to perform work in cylinder	800,000	66⅔
Escaped with steam into condenser	660,000	55
Transformed into work	140,000	11⅔
Absorbed in overcoming resistance of engine	40,000	3⅓
Available to turn the propeller	100,000	8⅓
Absorbed in useless resistance of screw.	20,000	1⅔
Usefully applied to propel the ship	80,000	6⅔

It has been customary heretofore, in order to determine the relative economy of marine engines, to weigh the amount of coal consumed in performing a certain amount of work. So long as the machines compared are of the same design and dimensions, the coal used of the same kind and quality, and the pressure of the steam, the degree of vacuum, the rate of expansion, the temperature of the atmosphere, and all other conditions are the same, it may be inferred that any difference, in the economy, is the result of some imperfection in the engine itself. But if there is a variation in one particular, as, for instance, in the degree of vacuum, the difference may be assumed to be due to that variation; but if there are several variations at the same time where there are different kinds of engines and boilers, and different steam pressures, when there is any gain or loss of economy, it is impossible to decide to which of the variations the change is due. So also in the case where high pressure of steam is carried, and a greater expansion is employed, if a poor economy is shown it may happen that the benefits that should result from the high pressure and the increased expansion were counteracted by the increased incondensation and leakage, or that the power which was gained in the engine, was lost the boiler, or *vice versa*. Then again any difference in the kind of fuel employed, or in the skill and management unites with the other variations to render the actual result more unsatisfactory.

In attempting to compare the results of such experiments as are recorded, to determine the most economical design of engine, it will be generally found that the experiments made to determine one certain point are not sufficiently complete to serve any other purpose. They have generally been made by different men, under different circumstances, and in different localities, and moreover the expert is almost invariably biased by prejudice. This is particularly applicable to the reports which may be obtained of the performances of new and improved engines, which may be accounted for in this way. A steamship company may place on its lines a vessel of fine model, with the most improved machinery, which on comparison would show more satisfactory results than one of the same capacity, but of inferior lines, and propelled by an inferior style of engine. It will be found on comparison that the profits resulting from the new ship and improved engines are largely in excess of those of the old, but it would be difficult at the same time to separate the gain due to the improvement in the model of the hull, from that due to the improved engine, and *vice versa*. All that can be done in such cases is to accept the whole result without being able to separate the one from the other. A series of exhaustive experiments to determine the relative economy of different classes of steam engines and boilers, is very much needed, but the difficulties to be encountered are so numerous as to render such an undertaking impracticable.



Fifteen Inch Shaper.

The accompanying illustration represents a small size shaper, of the Manville Patent, manufactured by The Hendy Machine Co., Wolcottville, Connecticut.

This machine has a stroke of 15 inches, crossfeed 15 inches, and will plane a piece 8 inches high, and is especially adapted for small and light work, and is also a *very strong* and rapid working machine; has quick return on back stroke and cone pulley with two changes for working the tool on the cut for steel or iron, &c. It is made of best material throughout, and the workmanship is first-class. It has steel shafts, and all gears and rack, also slots and holes in table are all cut from solid metal; all sliding surfaces are accurately fitted by scraping, screws nuts and wrenches, case hardened; feed screws made of steel and cut square threads. It has a graduated vise with steel jaws and steel screws.

Size of vise jaws, 7 inches long, 1¼ deep, jaws open 4 inches. Weight of machine, 850 lbs.

A Report of a U. S. Naval Commission, October 22nd, 1878, gives a very high commendation of The Manville Shaper, from which we extract as follows:

"This machine was carefully and thoroughly tested with various depths of cut and width of feed, planing to a line, angle and all the practical operations for which it was designed, and we find that while this shaper possesses all the advantages that are claimed for similar machines that are worked by a crank, in maintaining accuracy of stroke, it can be changed in an instant, while running, by the operator, from a fraction of an inch to any length of stroke desired, to twenty-four (24) inches in length, and at the same time preserving a perfect uniformity of speed of the tool.

"We failed to discover any disadvantages, and from a conviction that it is the Shaper known to the Board, in the market, and on account of its superiority, we recommend its general use for purposes connected with the U. S. Navy. It also occupies over one-third less space then any other Shaper known for the same range of work."

Jewelers' Lathes and Attachments.

The accompanying cuts represent jewelers' lathes and fixtures manufactured by the American Watch Tool Company, Waltham, Mass.

The dimensions of the lathes are as follows:

No. 1, swings 8 centimeters or 3.15 in.

Length of bed, 20 centimeters or 7.87 in.

No. 1½, swings 10 centimeters or 3.94 in.

Length of bed, 25 centimeters or 9.85 in.

No. 2, swings 12 centimeters or 4.72 in.

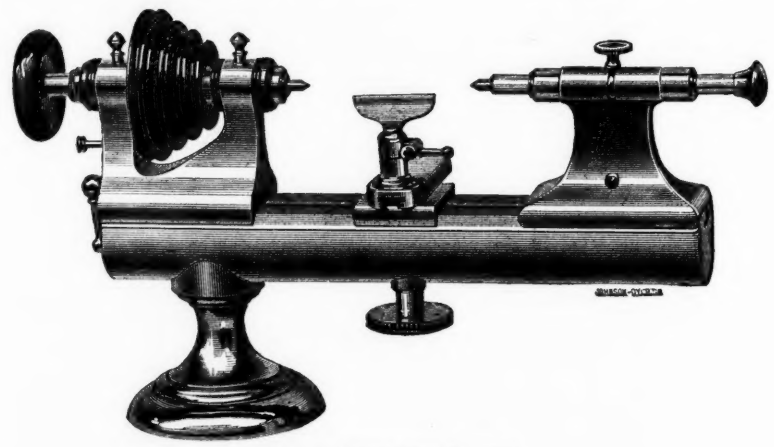
Length of bed, 30 centimeters or 11.85 in.

In the "hard lathes" the head and tailstock spindles and bushings are of the finest steel, hardened. All surfaces are highly polished and nickeled. The cone pulley is indexed 60 holes, so that a circle can be divided into 60, 30, 20, 15, 12, 10, 6, 5, 4, 3, and 2 equal divisions. The bearings have ornamental brass dust-rings to exclude dust and chips, and protect the workmen from flying oil. All lathes have a plain tailstock with a traverse spindle for light drilling. The spindle has a black rubber knob on one end; in the other end is a taper hole for drill chucks and other tools.

The attachments to the Nos. 1½ and 2 lathe are the improved universal head, step head, open tailstock, screw tailstock, jeweling rest, slide rest, pivot polisher, wig-wag, arbor squaring, rounding-up tool, No. 1 chuck head, and wheel cutter.

These lathes and attachments are a complete set of watchmakers' tools. When set upon a bench, which this company manufacture, at a window, they always attract attention by their high finish and tasteful appearance.

Their *Patent Universal Head* is considered by watchmakers who have used it as the most convenient offered to the trade. The pin which holds the pump-center is in a bushing at the back end of the spindle, and the groove for the pin is in the back end of the pump-center. By this plan the liability of dirt geting into the spindle is largely reduced.

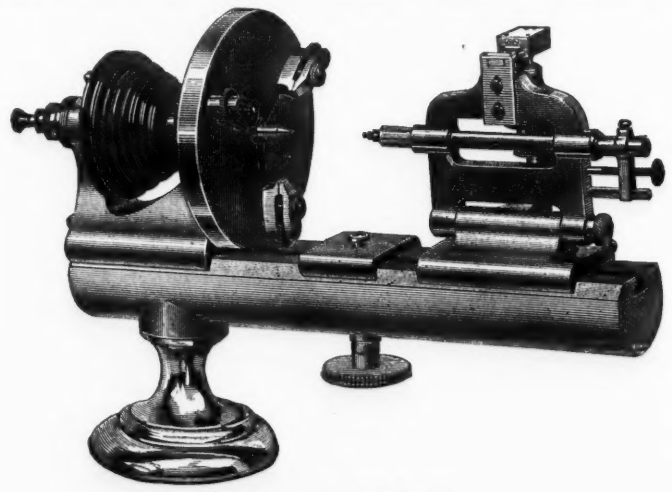


No. 1½ Jewelers' Lathe.

Their inproved method of operating the claimp screws saves the heavy thumb nuts, used on the Swiss universal head, and allows the dogs to be placed nearer the center. Both upper and lower clamps are secured by one nut, which is a great inprovement upon the Swiss plan.

The jeweling rest is for setting jewels in plates or settings. When made with calipers it measures each jewel separately, and turns a recess to fit. This attachment originated in the Waltham factory, and is fast becoming indispensable to jobbers.

They also manufacture a full line of wire chucks for the Nos. 1, 1½, and 2 Lathes forms a continuous hole from .3 to 5 millimeters, and are numbered on the face.



No. 2 Jewelers' Lathe.

They also make brass split chucks, for holding screws by the thread, for head finishing, or other work liable to be injured by steel chucks.

In the screw chuck, which is for holding cement chucks, the mouth is tapering and *ground true*, which insures the cement chucks always running true.

The lap whirl is an arrangement of pulley and lap holder on a chuck, and is driven by belting directly from the countershaft to this pulley. This plan saves driving the Lathe spindle when laps are to be driven at very high speed.

Mr. A. Webster, a member of this firm, was for nineteen years connected with the Waltham Watch Co., and was the first to introduce the metric system in watch factories, and has educated many workmen up to this standard. Mr. Webster designs and superintends the construction of tools and machinery for the manufacture and repairing of watches and watch cases, which is of itself a sufficient guarantee of the quality and accuracy of their tools. With each of their Lathes they give the following certificate:

"This certifies that the lathe marked American Watch Tool Co., No. — (Hard or Soft), was made by us from the best materials, on the most approved plan, and is a reliable Lathe. For any defect in material or workmanship we hold ourselves responsible." (Signed),

Waltham, 187

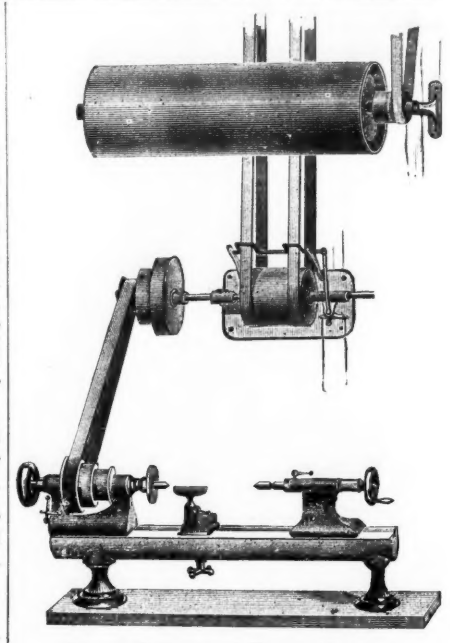
The machinist bench lathe, with its driving counters for lathe, and its grinding attachments, was originally designed for the American Watch Co., and has been adopted by all American watch companies and by many clock companies of this country, and watch companies of England and Switzerland.

It is in use by the Signal Service, armories, clock factories, optical companies, and many other manufacturers of fine work.

The bearings are made with two tapers, approximating the anti-friction curve.

Besides the centers, the self-centering wire chucks are used, taking in wire from one centimeter (3-8 in.) diameter to one millimeter (1-32 of an inch). Also any of the small sized scroll and independent jawed chucks in the market. The spindles, bearings and wire chucks are made of hardened steel, and ground true. The driving counter has two belts, driving from pulleys of different sizes; this, with the cone, gives six different speeds. The drum counter is to drive grinding attachments, which are designed to grind hardened steel, either holes or outside surfaces, at any angle, or straight. Slide rests and grinding attachment are accurately graduated into degrees; all surfaces well scraped and fitted.

The dimensions of this Lathe are: Swing, 18 centimeters, =7 inches. Between Centers, 30, 38 or 40 centimeters, = 12, 15 or 18 inches, as ordered.



No. 3 Jewelers' Bench Lathe.

In all their Lathes they use the Hollow Spindle and Spring Chucks, which are in general use in all the watch factories in this country, and which has proved to be the best and most reliable method of holding the various parts of the watch. Double taper bearings are used on the spindles. This form of bearing in 1864 took the place of the conical anti-friction principle in the American Watch Co.'s lathes, and was adopted by all the American watch companies, and is still in use by them. When made of hardened steel they have proved the most durable, and run with less friction than other bearings. The Cone Pulley on the Headstocks have been reversed in order to give more strength to the front-bearing standards, and to allow the index-pin to be put in the back standard of the Headstock, away from the chips and dirt which have proved a source of trouble at the opposite end.

The head and tailstock, and, as far as possible, all fixtures are secured to the bed by an improvement of bolt and eccentric; by this plan they are quickly attached and removed.

They use hard black rubber for pulleys, hand-wheels, etc., as the band clings to this material better than to any other substance; it also takes a high polish, and makes a fine contrast with the bright polished and nickeled surfaces of the lathe.

The head and tailstocks, and all the interchangeable parts and taper holes, are made to standard gauges, so that tools fitted to one, fit all equally well. This plan saves the necessity of sending the lathes to have extra fixtures fitted, if but a part is bought with the lathe.

The great expense of making their "Hard Lathe," which has so high a reputation wherever known, placing it beyond the means of many workmen, has induced them to make a "Soft Lathe," which is as accurate in its working parts as the "Hard Lathe."

They have adopted the metric system of measurement, as it is susceptible of finer subdivisions, which, experience teaches, leads to more accurate workmanship. Measurements can be sent either in inches, millimeters, or Stub's wire gauge.

Having a corps of excellent workmen, experienced in watch factory machinery, they guarantee superior work.

The Pratt & Whitney Co., Hartford, pay machinists 15 to 27 cents per hour, helpers 12 to 14 cents per hour, blacksmiths 21 to 25 cents per hour, pattern makers 24 to 26 cents per hour.

Sawtelle & Judd, Hartford, pay machinists an average of $2.25 a day, (the best $3.25), helpers $1.25, blacksmiths $2.00, engineer $2.50.

In Buffalo machinists from $1.25 to $2.50 a day, averaging $2.00, and boiler makers $2.00.

In Cincinnati machinists average $1.75 to $2.00 a day.

In Syracuse, N. Y., machinists average $2.00 to $2.25 a day.

In Cleveland, O., machinists average $2.00 a day.

In Rochester, N. Y., machinists are paid from $1.75 to $2.25 a day.

New Vertical Engine.

The above engraving represents a 1-horse-power steam engine which received a silver medal at the Maryland State Exhibition of 1878, manufactured by Plumley & Brown, 46 N. Holliday St., Baltimore, Md. It is put up with as much care as a larger one, and it is claimed to be made of the best material, and made for actual service, and not just to sell. The crank-shaft and connecting-rod are wrought iron. The piston, valve, and eccentric rods are of forged steel. The piston is provided with double ring, metal packing, automatically adjusted, consequently the cylinder-head does not need to be removed to set the rings out. The connecting-rod is so made that the wear can be taken up at both ends. The cross-head is solid with the piston-rod, and is of steel, thus avoiding a joint to get loose and thump. The guides are of the circular style, and the cross-head gibbs are adjusted by means of steel studs and lock nuts. The whole engine is highly finished, the cylinder is encased in black walnut, and the head and steam chest are polished. The journal boxes are provided with brass oil cups.

The cut represents the engine with a Pickering governor, but Messrs. Plumley & Brown are now prepared to furnish governors of their own manufacture. The engine is an ornament for any light manufacturing business, and is especially adapted for coffee and tea stores, as the engine can be set in a window and the boiler in any place desired. It is also adapted for dress-making establishments where several sewing machines are required, also cigar-box factories, scroll sawyers, mince meat makers, and, in fact, any business that requires light power. The boiler that goes with it is of the upright tubular style 1½ horse-power, made of $\frac{5}{16}$ best boiler iron, 16 inches diameter, and 19 1½ in. tubes, the furnace is lined with fire brick, thus retaining all the heat possible. The boiler is provided with a No. 7½ Hancock Inspirator for feeding, thereby doing away with a pump.

The boiler also has two gauge cocks, water gauge, safety valve and blow-off cock. Both engine and boiler are tested before leaving the shop, and are guaranteed as represented. The engine is supplied with governor, globe valve, oil cups, etc. Price of engine and boiler complete, $150. Messrs. P. & B. manufacture larger sizes to order, and claim it to be a light running engine, and will exert full rated power.

That "Corporations have no Souls" might be set down as an unimpeachable fact, if they were all like the Metropolitan Elevated Railroad Co. of this city That corporation made $112,000 last month, a very high percentage of profit; now they reduce their employees wages in order to make more by pinching them. Perhaps they have some tables prepared on the "reduced cost of living" for their employees benefit.

Important Improvement in Punching Iron and Steel.

In a treatise on the relative merits of iron and steel, for shipbuilding, read by B. Martell, Esq., Chief Surveyor of Lloyd's Register of British and Foreign Shipping, Member of Council, at a session of the Institution of Naval Architects, London, on the 11th of April, 1878, the Right Honorable Lord Hampton, G. C. B., D. C. L., President, in the chair, the following facts were shown.

First. That steel plates, very thin, suffer less from punching than iron.

Secondly. That the difference in loss of strength by punching on steel and iron does not appear sufficiently great to require special precautions to be taken for steel more than for iron in plates up to half an inch in thickness.

Thirdly. That in plates over half an inch in thickness, the loss of strength of iron plates ranged from 20 to 23 per cent., while in steel plates of the same thickness, it ranged from 22 to 33 per cent. of the original strength of the plate between the rivet holes; but

Fourthly. That by annealing the plates after punching, the whole of the lost strength was restored, and a similar result was obtained by rimming so as to remove the injured part around the hole.

Lastly. That in drilled plates no appreciable loss of tensile strength was observed.

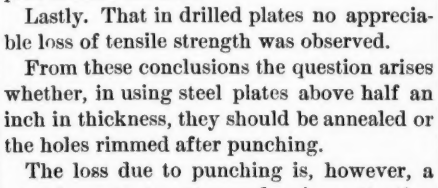
From these conclusions the question arises whether, in using steel plates above half an inch in thickness, they should be annealed or the holes rimmed after punching.

The loss due to punching is, however, a most important matter, and serious attention should be given to mitigating it.

"A step in the direction of rendering annealing or rimming after punching unnecessary has, I am glad to say, been taken by the introduction of Kennedy's *Patent Spiral Punch*, from which results of a very encouraging nature appear to have been obtained. On reference to table IV. it will be seen that by the use of this punch, the strength of the material after punching was about 2½ tons per square inch greater than by the use of the ordinary punch, whilst greater ductility was found to exist around the holes."

"Not a bad indication of the merits of a punch is the smallness of the power required to drive it through a plate; this measures the work that has to be absorbed in the production of heat or distortion during the operation of punching. I have been supplied with particulars which show that the SPIRAL PUNCH requires only about two-thirds the force behind it that an ordinary punch does; and, besides this, it acts more injuriously on the piece punched out, and less so on the surrounding plate."

We are sorry we have not room for the tables above referred to, but we give one or two items. In seven experiments that were made, in which two holes were punched in

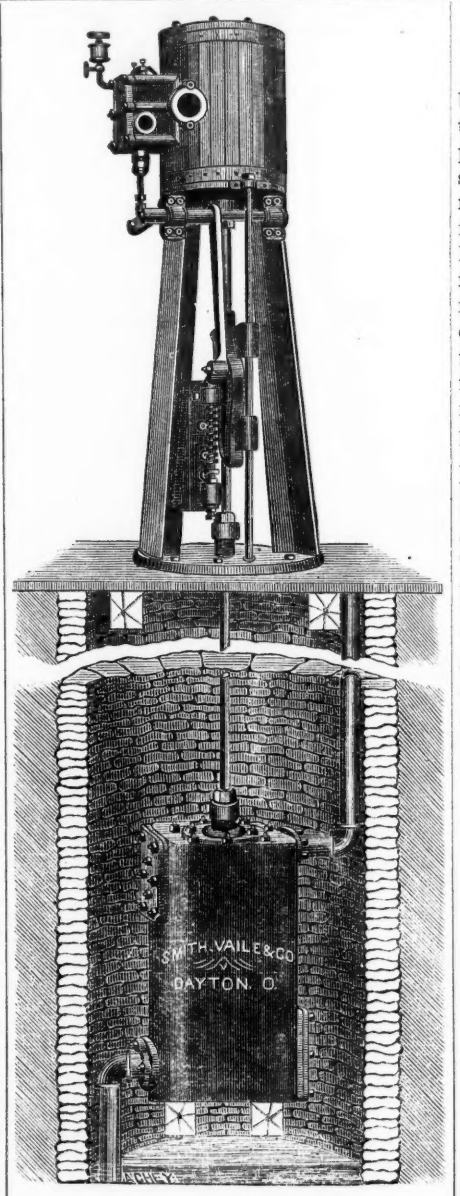


0.42 inch thick.

each specimen, as seen in above cut, one with the "flat punch" and one with the "spiral punch," all the specimens broke through the hole punched with the "flat punch."

And a ¼ "spirial punch" penetrated a ⅝ in. plate at a pressure of 22 to 25 tons, while a ⅞ "flat punch" in the same plate required 33 to 35 tons, thus showing a dead loss of ten tons of dead pressure on each hole, beside all the additional strain and wear of machinery.

The "spiral punch" is one more American improvement taken up by our English friends, and is the invention of D. L. Kennedy, of No. 10 Courtland Street, New York.



A New Deep Well Pump.

The engraving on this page represents one size of a new style of vertical deep well pumps. These pumps are made and especially adapted for deep wells, mines, shafts, and places where it is not possible or advisable to put in horizontal pumps. The steam cylinder, with all the working parts, is placed on top of curb, and the water cylinder on a platform or timbers near the surface of the water, the two connected by a rod of the required length.

This pump is a novelty in itself, and has only to be seen working to be fully appreciated.

It is claimed that it combines principles which no other pump manufactured possesses, viz.: a very gradual and positive throttling of the steam as it approaches the end of the stroke, causing a proportionate reduced speed of the piston, which descends or ascends, reversing its motion without the destructive jar incident to all other pumps. No auxiliary cylinders or superfluous cushioning devices being at all necessary, as the Dayton Cam Pumps—secured by several letters patent—absolutely control the motion so that no jar is perceptible. In changing its stroke only steam enough is given to the piston to start it back slowly, and once started, steam is admitted gradually and proportionate to its own motion.

To compensate for extra weight of long connecting rods, piston, &c., a valve is placed in the upper steam port, so arranged that the engineer can at will regulate the amount of steam, so that the down stroke can be made to work even more slowly than the up stroke. Also, by this device the manufacturers correct the existing fault of other pumps of a crowded or cramped exhaust, the exhaust with this device always remaining open and free. In these pumps the strain upon a long connecting rod is taken up easily, obviating the danger of breaking of rods by a too sudden reverse motion.

These pumps are manufactured by Smith, Vaile & Co., Dayton, Ohio, and are furnished in several different sizes.

How a whole City can be Heated.

The Springfield Gas Company have already begun heating buildings by the Holly system, the steam being brought in underground pipes 2,000 feet or more; although when the subject was first proposed one of our prominent business men said steam could not be forced across the street. The Chicago bank, H. & J. Brower's drug store and Dr. Church's residence on Elm street have had the steam for more than a week, and, as far as can be determined this mild weather, it works with full success. It was turned on at the Springfield Institution for Savings yesterday afternoon, and the whole building is to be supplied as soon as the pipes can be put in. Among other places to try it immediately are the First National Bank, Tobey's hat store, Swetland's candy establishment, and the offices over the Chicopee bank and Brewer's. The steam is brought from the gas works at the corner of State and Water streets, up Water to Elm and up Elm to Main street. The gas company do not require any additional boiler, and have used but very little extra fuel to furnish heat for the buildings already supplied, and could heat twice as much radiating surface without any more fuel.

The loss of pressure by condensation and friction between the Chicopee bank and the gas works is only 1½ pounds. The pressure on the street pipes is 20 to 25 pounds now, and Mr. Holly says he could heat the greater part of the city without increasing it to more than 30 pounds. But in the houses the pressure is always 2 pounds, no more nor no less, no matter how many radiators are filled with steam. This is brought about by regulating valves in the cellar, which reduce and regulate the pressure. The meter is attached to these valves, and is governed by a pendulum clock, which runs forty days and is so arranged that the consumer can read the amount registered from day to day. The main pipes expand when the steam is let into them 1⅞ inches every 100 feet, and to obviate that difficulty, junction boxes are placed at the end of every section of 100 feet, in which the ends of the pipes play. To the bottom of these boxes the service pipes, or laterals, are attached, so that all the water condensed in the mains is driven by the pressure of the laterals into the buildings, where it is let off by an automatic steam trap. Pipes also lead from each radiator to the trap, and a water pipe takes all the condensation into the sewer. This trap, the junction boxes, the regulating valves and meter, are the most important of Mr. Holly's patents.

The gas company, who have bought the right to use the system in this city, do not consider their present operations in the light of an experiment, after the success Mr. Holly has had in Lockport. Their five miles of mains and laterals were in use last winter; and this year they will be increased two miles. Houses a mile away were heated in the coldest weather as readily as those near at hand, and there was not an instance of grumbling on account of cost. Experiments have shown that an area of more than four miles square in any city or village can be warmed with one set of boilers. Rights have been sold for New York, Chicago, Detroit and other places. There seems at present nothing to prevent the general introduction of the system into the business places and dwellings of our city. The expense of fitting with pipes and apparatus is less than putting in an ordinary furnace, and in regard to the running expense, it is understood that the company will guarantee it shall not be more than the consumer's average coal bill for the past three years. But aside from the question of expense, the new system does away with all labor and dirt of stoves and furnaces. The steam is serviceable at the same time anywhere on the route for power. It is claimed that engines can be run economically, half a mile or a mile away, and Superintendent Dwight, of the Gas Company, says it will be quite handy to use when we get the electric lights for the streets. Altogether the system promises to work a revolution in the use of steam in more than one direction.—*Springfield Mass. Republican.*

German vs. American Trip Hammers.

The four illustrations shown herewith represent the trip hammers and forges used at the present time in Germany. They are photo-engraved from the catalogue of "Martin & Ise in Haspe," a copy of which was obtained by Mr. H. J. Bierhart, of Syracuse, while on a visit to Germany in 1877. They are not representations of machines which have become obsolete, for the catalogue was newly issued, and Mr. Bierhart saw hundreds of these hammers in daily use. We translate the following announcement from the publication referred to:

"These hammers are in different sizes. They are so constructed for water or steam power, and for all kinds of forgings, steel or iron plows, for plating and drawing the steel and forging files; also for forging and plating shovels, hoes, spades, plow shares, railroad forgings, (eisenbahnwaggonbeschlagtheilen), fences, knives, etc."

In Figure 1 we observe a single hammer in operation by water power. There is no record of its having been patented in the United States, and we assure our readers it will be perfectly safe to copy any of its valuable features they may admire. We call attention to its Arcadian simplicity, most of the materials for its construction being obtained from the primeval forest. It would be specially adapted to localities where timber is plenty and shop room cheap. The ease and comfort of the workman using this hammer are points not to be overlooked. Poised upon his graceful seat at the extremity of an adjustable swinging limb, solaced by a simple merschaum, he has only to guide the forging and propel himself about by the wooden shoes. To regulate the blows of the hammer, he pulls the lever and lets more or less water run upon the wheel. In figures 2 and 3 may be seen other styles of these improved hammers. Figure 4 is intended for an anvil forge, though it might be mistaken for the receptacle of the "old oaken bucket."

Mr. B. saw in a large cutlery works in Solin, ten trip hammers driven by ten different steam engines, either engine being large enough to drive three to five Bradley Cushioned Hammers. They did not understand how to run them all by a single engine and stop one conveniently without stopping all! The iron cylinder hammers contain 14 steel knuckles (or dogs) cast into the iron. Mr. B. noticed one of these cylinders over two feet in diameter, which weighed 16,000 pounds. Under each cut we give the translation of its designation in the catalogue.

We also illustrate the Bradley Rubber Cushioned Helve Hammer, as a direct contrast with the machines for like purposes used in Germany. This hammer has been before the public for some years, and has achieved an excellent reputation. Recently a number of valuable improvements have been added. It presents great capacity for work, ease of control and management, ready adjustability, compactness, durability, freedom from friction and consequent heating, and almost entire relief from the stubborn jar so annoying with most trip hammers. They are made (except the helve) entirely of iron and steel, and are so proportioned as to insure the greatest possible strength with the least amount of metal. The manufacturers, Bradley & Co., Syracuse, N. Y., make them of several different sizes, adapted to various kinds of work. While in Germany Mr. Bierhart was asked by a large manufacturer of axes, in Hagen, why Americans could send axes (of better make) to their country and undersell them 10 per cent. The answer was found in the fact that a workman could finish but 12 or 13 axes a day on the trip hammers here shown, while he could finish 50 on the Bradley hammer. The manufacturer then ordered five Bradley hammers.

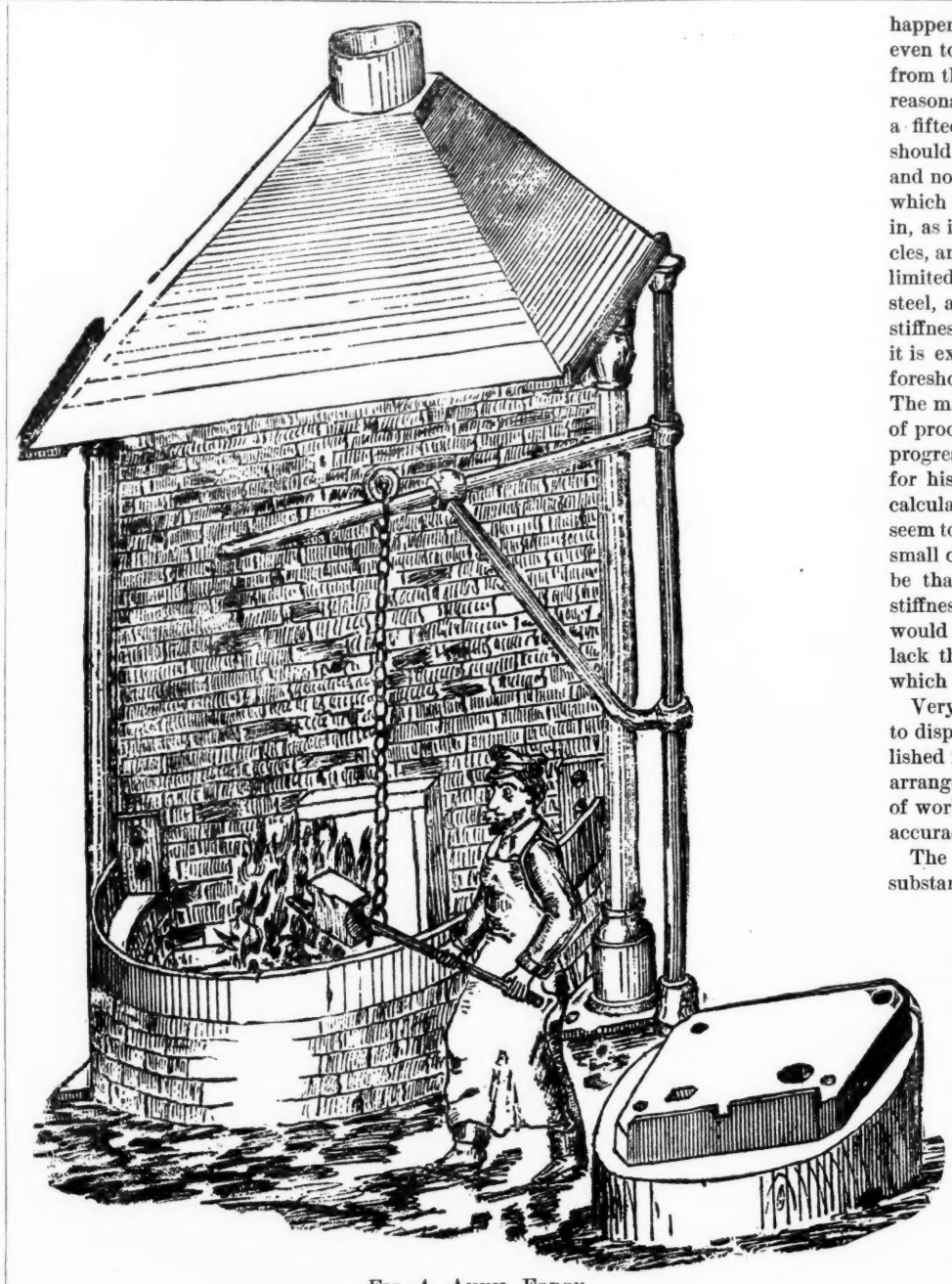


FIG. 4—ANVIL FORGE.

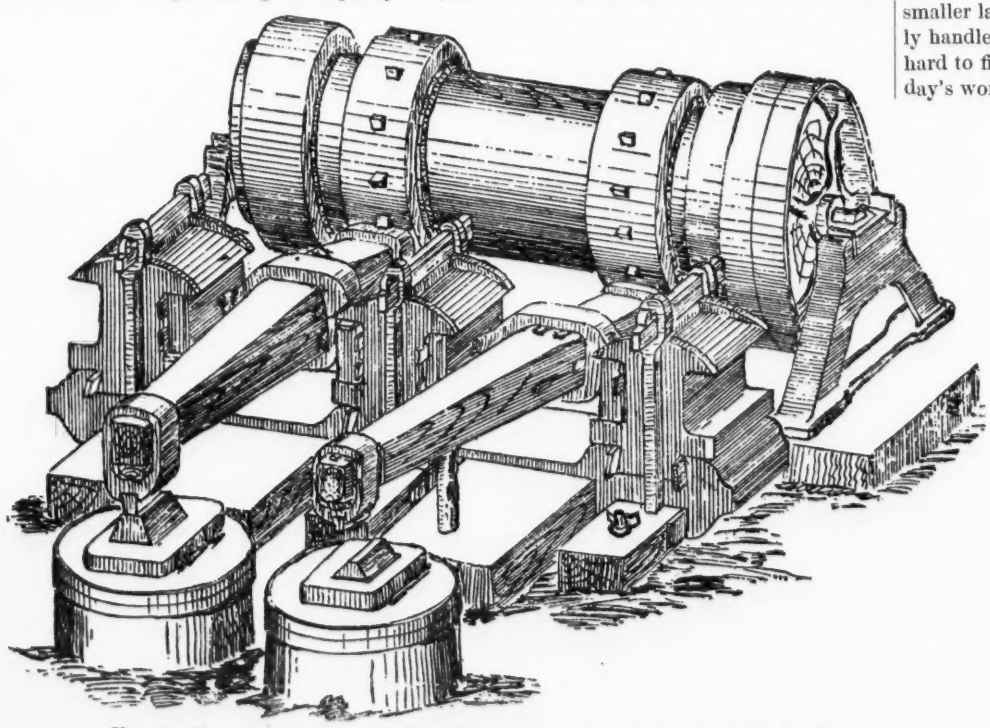


FIG. 2—TILT HAMMER, WITH CAST IRON CYLINDER AND WOODEN FOUNDATION.

Extracts from Chordal's Letters.

* * * * Did you ever stand over an eighteen-inch lathe and watch it nibble off little shavings of iron without wondering why the man who designed it, if it ever was designed, didn't make it powerful enough to take a healthy cut? If a four inch shaft is to be reduced considerably it can be done in a thirty-six inch lathe in about half the time it would require to do it in an eighteen-inch lathe, notwithstanding the fact that the smaller lathe may be much more conveniently handled. Up to fifteen years ago it was hard to find a lathe which would do a good day's work at roughing out unless the lathe happened to swing thirty inches or more, and even to-day we find some lathes being made from these same old patterns. It is not unreasonable to say that the difference between a fifteen-inch lathe and a thirty-inch lathe should be in their capacity to *admit* work, and not in their capacity to operate on work which they *will* admit. The arts are hemmed in, as ill luck will have it, by natural obstacles, and in cutting iron we are unfortunately limited in speed of cut by the nature of tool steel, and in the depth of cut by the lack of stiffness in the piece being worked upon, and it is exasperating to have even these limits foreshortened by lack of backbone in a lathe. The man who makes his bread and butter out of processes may well be satisfied with slow progression, but the man who looks to results for his pay finds these nibbling lathes well calculated to make him swear. Some makers seem to intend that a small tool shall take a small cut. The first thought of some might be that if a lathe were made of sufficient stiffness and power to do heavy work, it would be clumsy, inconvenient, and would lack that delicate power for accurate good which is so desirable in the smaller tools.

Very little experience or inquiry is needed to dispel such an idea, for it is a well established fact that those tool builders who have arranged their lathes to produce a maximum of work give us lathes possessing enduring accuracy, and exceptional convenience.

The more refined the accuracy the more substantial must be the general design of the structure, in order to assure anything permanent in its power for good. If an unfortunate mortal finds his shop full of consumptive lathes, he immediately sets about remedying the matter, that is if he has any competition in his business. Intelligent labor will double the product of a lathe, but such skill can work the same changes in a lathe having proper power, so something must be done with the machine itself. If the lathe is stiff enough to stand the racket its power may be increased with a very little trouble and with no expense. Inquiry will show that the fault is in the beltage of the cone. The proportion between belt velocity and cutting velocity is wrong. If the lathe is run slow enough there will appear to be power enough for the cut, this results from the increased velocity of the belt, but behold—the cut is too slow! It is known that the cutting tool will bear a velocity of twenty feet per minute and here we have but say twelve, which means that forty per cent. of the lathesman's wages are wasted and would be well invested in a better lathe. If in this case the speed of the countershaft be increased sixty per cent. the lathe will be found to have sufficient power at the proper speed, but it will also be found that the lathe will not do business at all satisfactorily upon its full swing or upon large diameters. This is bad, but is the best that can be done with such a lathe, for owing to wrong design in the back gearing the belt is incapable, under any circumstances, of doing proper work upon large work. The change

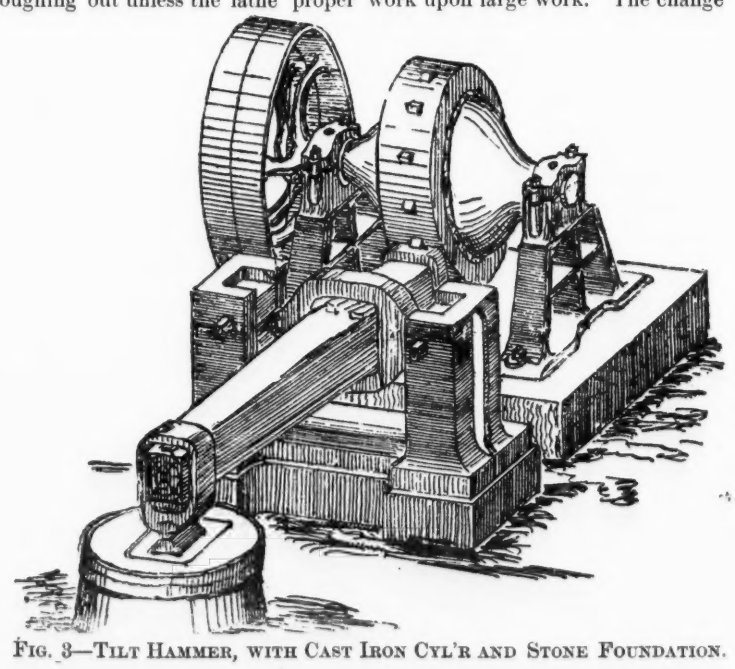
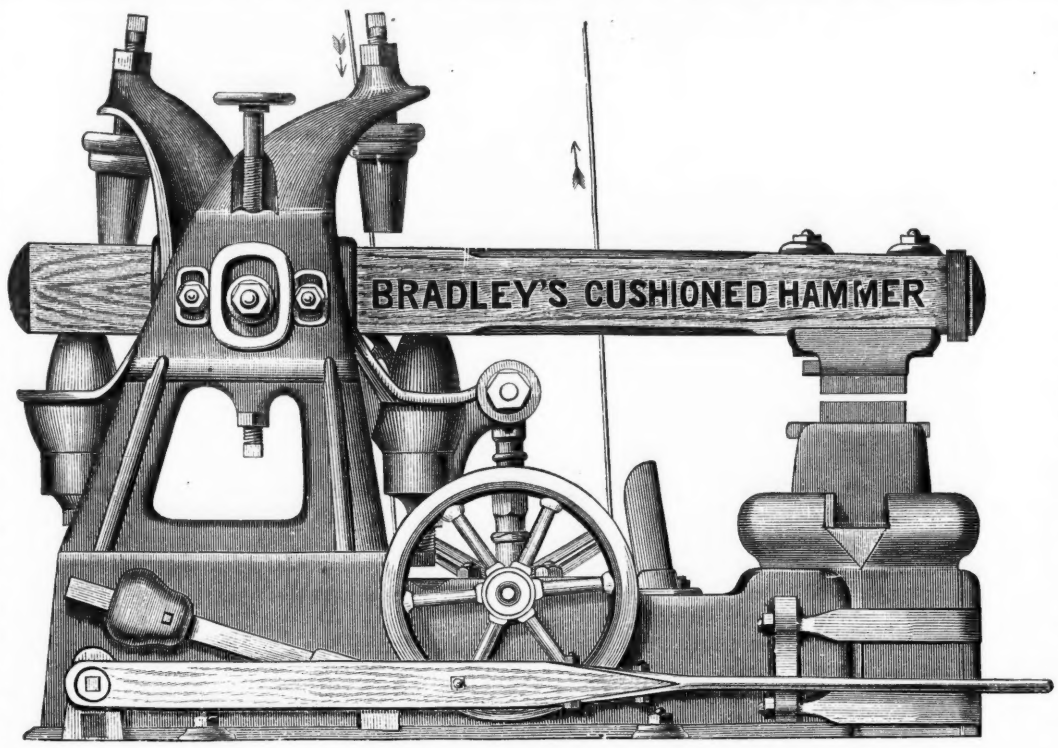


FIG. 3—TILT HAMMER, WITH CAST IRON CYL'R AND STONE FOUNDATION.



in speed of countershaft costs only a change in line shaft pulleys and makes what power the belt may have available for work, and within the new limits of swing the lathe will yield an increase of product in a year, which will buy a new lathe and allow the old one to be strained through the cupola. As such cases are apt to occur in every shop, it might be well to give a mathematical rule here for changing the speed of the counter shaft, but experience tells me that formulas are terrifying in most shops—that is the rank and file of the shops in the country. A trial based on a hint is better in many cases. It might be well to say, however, that the point of least power in all lathes of whatever make is when the belt is on the largest step of the lower cone. Lathes doing general shop work should be capable of work at the point of the tool, amounting to *not less* than thirty-five thousand foot pounds, and when the belt is on the large step below it should be capable of transmitting somewhere near that amount of power.

The strain of a lathe belt will average forty-five pounds for each inch in width. The width of the belt in inches multiplied by forty-five gives its strain, and 35,000 divided by this strain gives the least velocity in feet per minute at which the belt should run, and also the surface velocity at which the small strip of the upper cone should run. Its proper speed can then be found without trouble.

* * * * After the belt, the weak point in ill-constructed lathes is in the teeth upon the cone pinion, if this pinion is of cast iron, as is the case on cheap lathes, and in the teeth of the back gear wheel. The final or front gearing of lathes is rarely found too weak for their usual work. Once in a while a lathe can be found with a "lump" in its speeds, that is, it runs faster with the back gear in than it did with the back gear out and the belt on the large step below. Many a man will run such a lathe a month before finding this fault, and will gravely change his belt to suit changes in size of work without noticing the effect. It's much like the man who wound his clock every night for fourteen years before he found out that it was an eight day clock. In lathes of the triple-geared persuasion one may frequently find two of the aforesaid lumps in the speeds. Errors like these cost the shop-owner money continually, and it is well for him that they are getting rare. Well-intending and well-established tool builders are not guilty of sending out such machines, the errors generally lying with those builders who copy other makers' tools and recklessly add some inspiration of their own, without re-calculating the whole thing; such, for instance, as adding a step to a properly designed cone, or changing the proportion in one pair of the back wheels. The speeds of a good lathe will increase in a geometrical ratio, giving the smallest variations for the largest work, and the power will be sufficient to tax, to its utmost, *a turning tool.*

* * * * Short windedness in a planer is as common as it is in small lathes. One seldom finds a large planer refusing its duty, but five out of ten small ones will positively refuse to carry a Keyseat tool three-eighths wide, with a thirty-second depth of cut. This chronic disability in planers is really more annoying than in the case of lathes, for there are generally fewer planers in the shop to appeal to in cases of emergency. If a small lathe will not hold a cut we may put the job in a larger lathe, but in many shops there are no larger planers.

This suggests the question: Why will a small concern buy a small planer? Such shops frequently have half a dozen lathes of fair capacity, and a trifling little planer, about twenty inches between the housings. The affair will not take in a common sized job and will not do work on a piece it will take in. Such planers are fit only for light special work, and have no proper place in the general plant of a small shop, doing general work. Parties starting small shops buy everything they need—within their means; and then lay out the "tailings" of their cash in one of these insignificant little planers. They will always regret it, for it will not do their work, and will, by its useless presence, prevent them from getting one which will, for it may be many a long day before they can own two planers, especially if they depend on this little planer to earn the wherewithal. There is one safe rule for small concerns to follow when the planer question comes up. Let the first planer purchased be three feet between the housings and the same under the top brace, and of sufficient power to do work. If such a tool cannot be bought, owing to low funds, better do without, and get along with hammer and chisel till funds increase. I know one firm who rather than buy one of these small planers, or go in debt—one's as bad as the other—did without for a year, and, in that time built ten stationary engines. Wages were high, and it made lots of hard work, but the engines were profitable, and now the concern has two planers, two shapers and a little planer. The last named was very properly the last purchased.

* * * * Sackett has got a planer arrangement which it would pay any one to see and copy. He had a good forty-inch planer, and, by a slight additional investment he has arranged the thing to do work of any size whatever. The plan is well known in large shops, but the smaller shops, which need such things the most, will do well to listen. A heavy, slotted plate is planted under the planer, about four feet ahead of the housings. The plate is about five by fifteen feet, and sits across the planer, projecting equally on each side. It is truly planed on top, and is set true with the planer table, and bolted to the planer by short legs reaching up. It is simply a slotted floor, true with the planer table. He has a heavy knee with a broad base to bolt to this plate. The knee is practically a planer rail set upright and having a saddle, &c., the same as a planer. A job too large to go through the housings may be bolted to the table, as usual, and operated on by the tool in this knee; and, in case of extra large work, the job may be bolted to the plate and the knee bolted to the planer table. The knee has hand-feeds in all directions, and, in connection with this planer, will do the best of work on any sized piece which can be got into a shop. There is nothing shaky or temporary about the affair, and, to all intents and purposes, it is as good as a planer which will take in a cathedral.

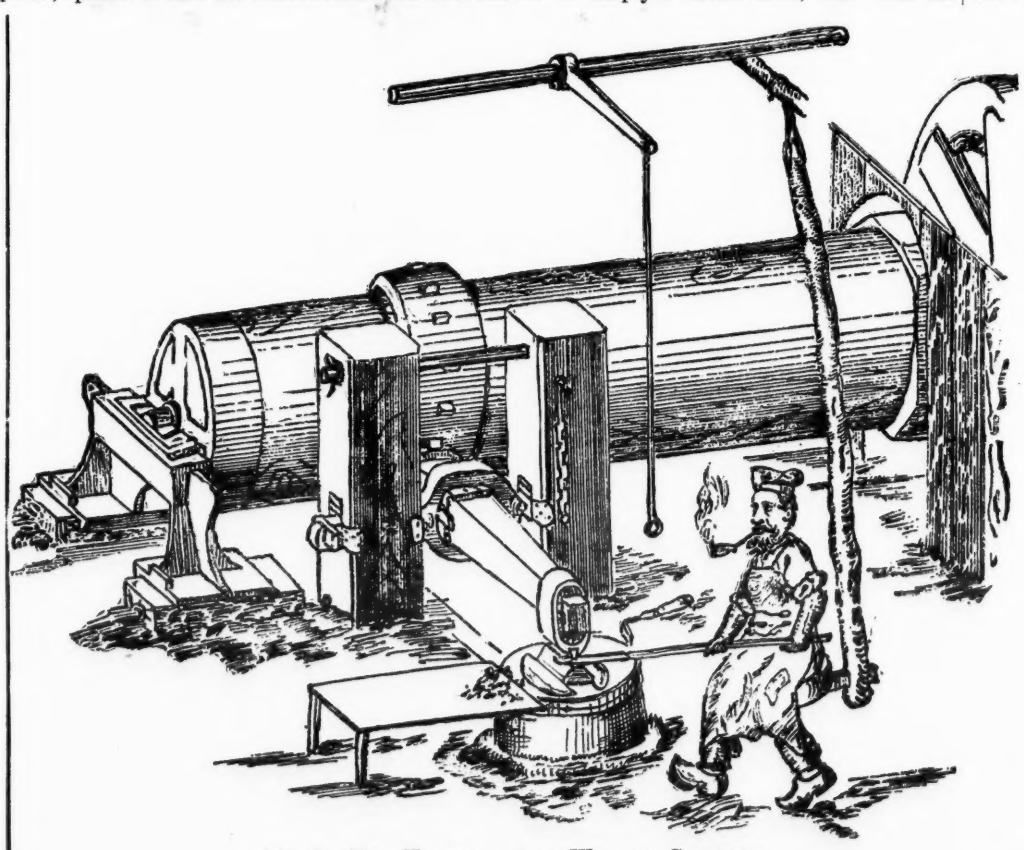


FIG 1.—TILT-HAMMER, WITH WOODEN CYLINDER

* * * * Sackett has a little arrangement in the foundry which captured me on sight. It is a device for making common round cores, from one-half inch to three inches in diameter. Instead of making a car-load of core boxes every year, he made a set of common boxes, all eighteen inches long, and for all diameters up to three inches. They were of uniform size outside. Each core box has an iron plug sliding within it. This plug is bored in one end the shape of the core prints, and, by the way, all his core prints are of uniform length and taper, and the other end has a three-eighths hole in it. The core bench is provided with a socket in which any of the core boxes will stand upright and solid. In the center of the socket slides a graduated rod, on the upper end of which the plugs will fit. If his coreman wants a two-inch core, ten inches long, he sets the rod at the figure ten, puts the two-inch plug on its upper end, and sets the two-inch core box in the socket, and then makes the core as usual.

* * * * It won't do to jump at the cost of small tools in the shop. Figures printed on a manufacturer's price-list often look big, but if accurate cost of small home-made shop tools is kept, something will be found out. What shop can make an inch tap as cheap as one can be bought? When a concern fits up specially for a certain class of tools, it is safe to say that their price-list is about fifty per cent. under the cost of home-made tools. A one-inch solid, double-ended caliper for the tool room can be bought for a dollar and a half. Leaving out any consideration of accuracy, how much would it cost if a three dollar man made it with the ordinary facilities? Gear cutting cutters, so near absolute perfection as to be unquestionable, can be bought for about six dollars each. It looks like a great deal of money for very little steel, but have one made in the shop, and watch it. A steel forging of unreasonable size keeps a blacksmith and helper busy an hour; your draughtsman spends an hour drawing a shape on tin; your best paid lathesman works a full day turning the cutter, if he don't make a special tool for it, and he works a day on the tool, if he does make it; then half a day goes in toothing it, and you may put in proper wages and figure up the cost. When it comes to tempering it, it may be done, or it may be done for; it depends on luck, and if tempered without cracking it, may be true and may not be; and if it ain't true it won't cut a space anything like the draughtsman's tin drawing, which may have been a good shape and may not have been. Price-lists are often condemned prematurely.

Very respectfully,

CHORDAL.

The Board of Supervising Inspectors of Steamboats has adopted unanimously the following rule: Local inspectors, at their annual inspection of steam boilers, shall remove from the surface of such boilers as are covered, so much of the covering as is necessary to enable them to examine such parts of the boilers as cannot be properly examined from the inside.

The Stow Flexible Shaft Company, of Philadelphia, has its whole available force at work on European orders. It has recently sent shafts and drills to the Knowles Steam Pump Works, the Buckeye Engine Company, the Union Railway and Transit Company, of St. Louis, and other well-known concerns.

AMERICAN MACHINIST

PUBLISHED MONTHLY

BY

MILLER & BAILEY,

Editors and Proprietors,

75 Fulton Street, New York.

H. B. MILLER. JACKSON BAILEY.

Edition, 7,500 Copies.

The Trade supplied by The American News Company and Branches.

SUBSCRIPTION.

$1.00 per year, in advance, United States Postage prepaid.

To Foreign Countries, $1.00, postage added.

ADVERTISING.

Outside page, 35c. per line, each insertion.

Inside pages, 20c. per line, (12 lines one inch.)

EUROPEAN AGENCY.

The International News Company, 11 Bouverie St., Fleet St., London, will receive and forward subscriptions and advertisements on our regular terms.

EDITORIAL ANNOUNCEMENT.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, FEB'Y 15, 1879.

The Holly System of Steam Heating.

Since the introduction of a system of steam heating, cooking and supplying motive power to the people of cities and villages, through pipes laid in the public streets from a battery of boilers centrally located, by Mr. Birdsill Holly last winter, considerable discussion has been called forth in regard to the merits of the plan and the probabilities of its general adoption. In order to obtain a correct knowledge of the plan, and the success already achieved, where given a thorough trial, we recently made a trip to Lockport, N. Y., and spent two days in examining its special features, during which time every needed facility was freely afforded us by Mr. Holly and the managers of the Holly Steam Combination Co. to become acquainted with its details and the actual results there produced. The city of Lockport, although some distance from the Polar regions, takes rank for rigor of climate with any town south of Duluth, and the severity of the present winter has been sufficient to thoroughly test any method of heating buildings. The most diligent inquiry convinced us that there has been no failure on the part of the Holly Steam Heating System to furnish the steadiest and best heat to all of its consumers on the coldest as well as the warmest days, there being no difference in the quality or quantity supplied at points farthest from the boilers (over a mile) and nearest to them. Last winter when the system was first put into operation in that city there were comparatively few consumers on the company's books, although scattered widely; this winter they have four times the number then using it, and we heard the opinion expressed by the citizens that by next winter most of the buildings in town will be heated by the Holly system. This plan of heating from a central source when first opened to the public for patronage was regarded as experimental; now, that its successful operation has been proved beyond cavil, its rapid adoption throughout the country will occasion no surprise.

As previously noted in these columns the right has been secured from the proper authorities to lay pipes and furnish steam on the Holly plan in this city, and a plant is soon to be established and set into operation. A few cities and towns have introduced the system this winter, from all of which the most gratifying accounts have been received, every consumer being well pleased with the results.

The details of the system have been carefully worked out and perfected by Mr. Holly. A plant of boilers located at some central point generates the steam, from which it passes through street mains, made of lap-welded iron pipe and covered with non-conducting materials. The pipes are inserted in logs of wood, hewn square externally, and battened on each side, over which hemlock boards are nailed, leaving an air space. The whole outer surface is then doped with coal tar and a course of drain tile laid along the whole line, connecting at low points with the sewer. The pipe is not laid deep in the ground. To provide for expansion there are cast-iron junction boxes, at intervals of about 100 feet, into which the main enters by a stuffing box packed from the outside. The departing length is connected with the box by a spherical joint packed with asbestos, which provides against disturbance from settling or a change of grade. These boxes are accessible from the street, and all service pipes are made to connect with them, the mains not being tapped anywhere. Within the junction box is an adjustable funnel mouth, which may be turned up or down, causing the delivery, at will, of either dry or wet steam, or accumulated water. On entering a building, the steam passes an automatic reducing valve, which keeps it at a constant pressure of 10 pounds, without regard to the pressure in mains. A second valve reduces the pressure to three or four pounds, as required for use.

An ingenious steam meter accurately records the amount of steam used by each consumer. In the building steam is distributed, as usual, by pipes and radiators of any suitable design, or by Mr. Holly's Atmospheric Pressure Radiator, at the option of consumers. The latter is a set of vertical tubes of tin or any other sheet metal, closed at the top and open at the bottom. Steam is admitted at the top, and being lighter than air displaces it and fills the radiator from the top downwards. An index valve is used to regulate the quantity of steam in the tubes, by means of which the heat can be admitted as desired. These radiators are neatly ornamented, safe and inexpensive. They constitute a great favorite in Lockport.

The water of condensation is carried to a trap, from which it is circulated around the "indirect," a large number of return bends in the cellar. The heat is then served through registers. In this way all the available heat is utilized, and the building thoroughly ventilated. An "accumulator" is placed in the kitchen for serving hot and cold water, having connection with the unreduced pressure in the main. Water may also be elevated to the top of a building by the steam pressure. Steam pipes with hose connections convey steam for bath-room, for boiling, for laundry purposes, etc. Steam cooking apparatus is now being perfected.

The condensation which was expected by many engineers to be considerable has been shown to be very small. For example: 1,600 feet of 3-inch pipe, in extreme cold weather, showed a loss of but $2\frac{1}{4}$ per cent. of its capacity at ten pounds pressure. In large pipes greater economy can be secured, for condensation only doubles with the diameter, while capacity increases in a much greater ratio. As not over 50 lbs. pressure need be carried in the street mains, it will be seen that there is no danger from explosion. It is the opinion of expert engineers who have investigated the whole system that all apparent obstacles to its practical and economical working have been overcome. The patents that have been secured by Mr. Holly, on inventions constituting his system of steam heating, embrace thirty strong and positive claims, covering not only the employment of steam with the combinations originated, but also hot air and hot water. The steam service is not only well adapted to heating and domestic uses, but for driving fire engines and stationary engines, also for removing snow from the streets.

As regards economy, the tests thus far have shown that the same amount of heat can be supplied at a handsome profit for what coal and wood bills of consumers would amount to. The convenience and healthfulness of steam heating, as compared with the use of stoves, are too obvious to dwell upon. With the Holly plan it averts danger of conflagrations, and therefore reduces rates of insurance. Its advantages might be dwelt upon at great length. As the bulk of people live in cities and villages, Mr. Holly has certainly earned distinction as a public benefactor; first by the introduction and verification of his excellent water-works system, and now by his steam-heating system, which is destined to work more important changes than the former.

Boiler Explosions.

We have before us in the January number of *The Locomotive*, issued by the Hartford Steam Boiler Inspection and Insurance Co., a record of boiler explosions for the year 1878, with a brief statement of circumstances in each case, which affords steam users material for an interesting study. The list is by no means a short one, and the loss of lives sum up to a fearful figure. Almost every one of these explosions could have been prevented by proper precautions. The causes of nearly all these frequent devastations in the use of steam may be set down to defective boilers and bad management. How often do we hear of the explosion of a well-built (material and workmanship) and well cared for boiler? The "visitations of Providence," so pathetically spoken of in the obsequies of victims of a bursted boiler, are nothing but the sure carrying out of the unalterable law of *cause* and *effect*. If a man undertake to play foot-ball with dynamite, no matter how safe he may feel, the result is likely to be disastrous. If a defective boiler is run with the same confidence as a sound and substantial one the consequences must be unfavorable, for steam has a rending power of no mean rank. When we consider the extent to which cheap inferior material has been worked into boilers, within two or three years, it is no wonder that appalling accidents are becoming so frequent in the use of steam boilers. These are but the legitimate fruit of using low grade plates, old rusty tubes redrawn, poor rivets and hasty unscrupulous workmanship. Competition in prices has been so close that boiler makers who use the best materials and the greatest care in construction have found themselves so far underbid by members of the craft who use cheap and unreliable stock as to be unable to compete. We regret that steam users have the greatest inclination to buy boilers from the cheapest builder, which gives too large a proportion of the business to sordid and untrustworthy parties. Purchasers do not seem to be impressed with the great responsibility of making steam in weak and unsubstantial boilers. They may often be deceived by misrepresentation on the part of the boiler maker. The stamp "C. H. No. 1" on boiler plate is supposed to mean that it is first-class charcoal hammered iron, and "C No. I" a good quality of charcoal iron, but we know of boiler plate mills that stamp these brands upon common tank iron at the option of their customers. These marks have therefore become suspicious, unless accompanied by the name or trade mark of the manufacturer of the plate. Our attention has lately been called to the practice of placing common wrought iron 3-inch gas pipe among the tubes in new boilers. We, some months ago, directed attention to the manufacture of boilers from common safe (practically unsafe) plates. Almost every species of chicanery seems to have been studied to make and sell boilers cheap. One of the most unblushing frauds in this business, which we have several times called attention to in these columns, is that of redrawing and brightening up old worn tubes and selling them as new ones. This fraud is extended by boiler makers who use such tubes *knowingly*, and palm them off upon their customers in new boilers. Are there not efficient methods of discouraging the making of insecure boilers? We believe that boiler insurance has accomplished a great deal in this direction, and can be made to do more. In granting certificates of inspection would it not be well to state therein what the boilers are made of, *i. e.*, what stamp is found on the plates and tubes? Would it not elevate the standard of materials and raise the grade of steam boilers by placing before manufacturers incentives to excel? A boiler made of fire-box iron should rank higher on a certificate of inspection than one made of "C. No. 1." We offer this suggestion, but if mistaken, would be glad to be corrected.

Western Machinery Progress.

In a recent trip through a portion of the West we visited quite a number of machine shops, both large and small, with a view to ascertain the progress they are making in processes in designing, finishing, etc. A notion is generally entertained that machinery made in the West is much inferior, as a class, to that made in the East; but, however this may have been in the past, our observations do not give us that impression now. While in fine machinery and small tools the West can scarcely lay claim to equal the best productions of New England and Philadelphia, they are perfecting their designs and workmanship with a rapidity that excites the wonder and admiration of mechanical engineers. In general shop tools their progress is full as rapid as in any other section of our country. We noticed in Ohio some special machinery that, for ingenuity and perfect adaptation, must take rank with the most advanced mechanical inventions of our day. It is to the extensive introduction of special machinery that the West may justly look for the means of heading off the competition of Eastern mechanical supplies. They seem alive to the importance of such a course, and to this end are attracting to their workshops a class of expert mechanics, whose services are duly valued and fairly rewarded.

In minor details there seems to be ample room for improvement in most Western shops. Too many large shops are poorly constructed, the floors uneven and not firm enough to afford good foundations for large tools, light and ventilation imperfect, and conveniences for systematic work, through their several departments, illy provided for. While passing through some of these shops, we would suddenly come upon a "jumping off place" from one part of the floor to another, and in one instance, opening the wrong door, came near being precipitated to the bottom of an open elevator way. "Heaven's first law" would seem to be held in disrespect by a great many machine shop and foundry managers—to judge from the littered-up condition exhibited by floors and yards, and even offices. It may be regarded as picturesque to present a haphazard array of heaps of broken castings, iron turnings, dust heaps, old core boxes, discarded patterns and disused tools, but our imagination is not sufficiently cultivated to appreciate its high artistic effect We saw in a Western foundry some of the best surfaced and most uniform appearing large iron castings that have anywhere came under our notice, but this establishment formed an exception to the usual style of workmanship displayed by most foundries we visited. It cannot be denied that the West needs, as a rule, to put forth more skill in moulding iron, and with the incentives ahead she is likely to "grasp the situation." In brass casting our observations showed greater perfection. The manufacture of small tools is making rapid progress in the West, both as regards variety and accuracy. Competition with the East is becoming strong. The West has for some time taken the lead in manufacturing agricultural tools and machines, and this branch of industry is constantly enlarging.

Several communications, original articles and answers to questions sent us are unavoidably laid over to our next issue.

Not A Bad Record.

The following is the record of the Pawtucket Corliss Pumping Engine, from December 23d, 1878, at 7 o'clock A. M., to January 23d, 1879, at 7 o'clock A. M., 744 hours:

Runnin time, 187 hours, 35 minutes.	
Revolutions of Engine per counter,	551,450
Average Water Pressure per gauge,	101,633 lbs.
Average distance from center of water-gauge to surface of water in pump well, per float index, 16.7696 ft. divided by 2.31 =	7.259 lbs.
Total Head or Lift,	108,892 lbs
Wood used for kindling, 770 lbs., @ 45 per cent., =	346½ lbs. coal.
Coal used for kindling,	4800 lbs.
Coal used for running,	53,271 lbs.
Coal used for banking,	1625 lbs.
Total Fuel,	60,042½ lbs. coal.

During 21 days of 24 hours each when the engine did not run at all, 10,870 lbs. of coal were used for heating the engine station. Proportionally, the quantity of coal required to heat the building for the 744 hours is 16,046 lbs. Deducting this from the total fuel and the balance, 43,996½ lbs. is the *actual total fuel* used for pumping purposes.

The net area of the pump plunger is 82.01178 square inches.

The plungers travel 10 feet to each revolution of engine.

The duty for the whole 31 days is therefore:

$$\frac{82.01178 \text{ in.} \times 108.892 \text{ lbs.} \times 10 \text{ ft.} \times 551{,}450 \text{ revs.} \times 100}{43{,}996\frac{1}{2}}$$

equal to 111,933,536 foot pounds per 100 lbs. of coal.—*Pawtucket Gazette & Cronicle, January* 24, 1879.

MANUFACTURES.

On a recent tour through New York State and the West we visited a number of shops, and saw many things of special interest, but regret that the limits of our space this month will admit of but little reference to to them. While in Rochester, we were particularly interested in looking through the large establishment of Woodbury, Booth & Pryor, who are quite busy in building steam engines and boilers. They make a full line of both automatic cut-off and slide-valve engines, their patterns covering a wide range of sizes and styles. Their automatic cut-off engine has been designed to meet the wants of these progressive times, and will hereafter be described in our columns. In the construction of steam boilers they exercise unusual care. The plates used are all either C. H. No. 1 Fire Box, or No. 1 Flange, and tubes, braces, castings, rivets, and every species of material must come up to the highest standard before they find use in their shop. They have for 25 years made and sold boilers extensively over a large portion of this country; and *not one of them has ever exploded*—so far as information can be obtained. Besides securing safety from accidents, it is cheaper in the end to buy first-class boilers, though they cost more at first than the ramshackle affairs so often sold for good ones at low prices.

Newton & Cox, of Cleveland, O., are making an excellent class of machinists' small tools, embracing twist, drills, taps, dies, reamers, and screw plates. They make a self-feeding reamer, threaded on the end like a tap, which seems to work admirably. A new milling machine has just been brought out by this firm.

In heavy machine tools the Niles works, at Hamilton, O., take the lead for the West. We noticed building in their shop a large boring and turning mill for Glasgow, Scotland. They have already sent seven large iron-working machines to Glasgow. For the past few months they have sent a car load of machinery every month to San Francisco. A ten-foot boring mill had just been shipped to Utah, and another large one to the Oregon Steam Navigation Company. Their shops are now running until ten o'clock every night.

Griffith & Wedge, at Zanesville, O., have brought out a new style of vertical engine. We saw one of 60 horse-power at work, and remarked the regularity of its motion, and the misplicity and symmetry of its design. This firm has a large shop, and are making an extensive variety of engines, boilers, and machinery. Some months ago they fitted up the shops of the American Encaustic Tiling Company, of that city, with all the machinery they use, from the engine to the most intricate special machines. The latter establishment is now turning out tiling, both plain and ornamental, to equal the best production of England, and they are the pioneers of this business for the United States.

The oldest machine shop in Zanesville is that of Duvall & Co. It built the first portable engine and saw mill in Ohio. The present firm is composed of five men, all practical workmen. One is general manager and superintendent, one foreman of machinery department, one foreman of the forging department, another of the boiler department, and another of the machine shop. Their principal manufactures are portable engines and boilers. It is an enterprising establishment.

YONKERS, N. Y.,
February 3, 1879.

EDITORS AMERICAN MACHINIST,

Gentlemen:—In your December issue a communication appeared, which, while pretending to be a discussion of the relative merits of the Hydrostatic and Hammer Tests, wandered from the subject to attack me in a manner in which the same writer has heretofore done without eliciting a reply; and which would now be passed over in silence were I the only one attacked, as anywhere—where the writer of that article and myself are well known—it could have no effect upon my reputation. But when the Mayor and gentlemen of the Common Council are attacked in this manner, because they considered me better qualified for the position of Inspector of Engineers and of Steam Boilers than the writer of that article, then, Mr. Editor, I must beg to reply.

The facts of the case are, that the writer of that article was an applicant for the position I now hold. But the Mayor and Common Council believing others equally eligible and fully as well qualified declined to appoint him. And if I had not been confirmed by the Council, another gentleman, fully as well, or perhaps better qualified than either of us, would probably have been the choice of the council. He knows nothing about me personally, and I believe but little from hearsay.

Now about testing boilers. The writer of the before-mentioned article says it would be better to combine the best features of the Hydrostatic and the Hammer Tests; if so, why did he, in the Ordinance he says he *assisted in drawing up*, make it imperative on the inspector to test by Hydrostatic pressure alone?

He would, also, have one man do all the examining of engineers and inspecting of boilers. It was the desire of the writer of that article to exercise his *One Man Power* that first called forth protests to the Ordinance in this city, and two competent mechanics and engineers were called before the committee to rectify the mistakes of *one incompetent one*. And the Ordinance was amended so as to appoint two competent engineers, not then running engines, to assist the inspector in examining engineers, and the inspector was allowed to make use of the hammer in making tests. And since my appointment I have uniformly made more use of my hammer than of my pump. And I can point with pride to the fact that in the two years I have filled the office of inspector there has not been a single accident from steam in this city. And if there have been any engineers licensed who are not strictly *first-class*, it is the fault of the Ordinance your correspondent says he assisted in drawing up, rather than of the examiners.

As to "political considerations," I am assured by a majority of those who supported me, that they did not and do not now know my politics, and were only actuated by a desire to have the best man appointed, without reference to politics or anything else, except capability.

In conclusion, allow me to say I do not call myself an "expert," but if about fifteen years' experience building steam engines and boilers and using every style from small portable to railroad locomotives, would make a practical engineer, I claim to be one.

Yours,

JAMES MONTGOMERY,
Inspector of Boilers and Engineers.

Business Specials.

Thirty cents a line for each insertion under this head.

"Brown & Sharpe M'f'g Co., Providence, R. I., keep in stock at reduced prices Patent Cutters for the teeth of gears which can be sharpened by grinding without changing their form. All wheels of same pitch cut with them will run together correctly. Send for new catologue."

Gear Cutting Attachment for Lathes, Cuts, Spin, Bevel, Works and Skew Gears as well, and more conveniently than a gear cutter. Address Jackson & Tyler, 27 German St., Baltimore, Md.

The Pratt & Whitney Co., of Hartford, Conn., make a specialty of Cutters for the teeth of gear wheels, that are shaped entirely by machinery and will make interchangeable all gears that are cut with cutters of the same pitch.

For Drop-Forging, Packer Ratchet Drills, Lathe Dogs, Screw Plates and Dies, Address The Billings & Spencer Co., Hartford, Conn.

WANTED—The address of parties having for sale a second-hand Screw Cutting Engine Lathe with modern improvements, to turn twelve feet between centers, three feet swing; together with full description of same, time it has been in use, maker's name and lowest cash price delivered in this city. Manufacturers please send lowest cash price for new lathe of above dimensions. F. A. Howard, Belfast, Maine.

National Steam Pump, simple, reliable and durable. Send for illustrated catalogue with reduced price list. W. E. Kelly, New Brunswick, N. J.

Latest and best Books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Questions and Answers,

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) C. F. H., Lynn, Mass., says: Please inform me through your February No. if you know of a way to temper lathe tools for cast iron work, that will not grind away. It is very often the case that the tool cannot get in under the skin of the casting the whole turn of the lathe, such as squaring up cams to work that sort? A. Make the tools of the best tool steel, and work them at a cherry red heat. If the tool has not been over-heated, it will stand to heat to a cherry red, and plunge it instantly into cold water. If this does not make it hard enough, use the compound given in answers to correspondents in this number. The speed of the lathe must be very slow—a most important point. Chilled tools made of cast iron are used in some shops, but we have very little faith in them.

(2) M. F., Red Hook, N. Y., writes: Will you be so kind as to give me a little information through the columns of your valuable paper? 1st—I am 30 years old—am I too old to learn the machinist trade? I have some knowledge of machinery. I would prefer New Jersey R. R. Repair shops. I can give first-class references. I have no friends in New Jersey to intercede for me. What is the best course for me to pursue, and what wages I would be likely to get? A. Never too late to learn. Socrates at an extremely old age learned to play musical instruments. Cato at 80 learned the Greek language. Boccacio was 35 when he began the study of light literature, yet he became one of the greatest masters of the Tuscan Dialect. Franklin did not commence fully his philosophical pursuits until his 50th year. Dryden in his 68th year commenced the translation of the Iliad, his most pleasing production. We might go on and cite thousands of cases; but every one familiar with the biographies of distinguished men will recolect individual cases enough to convince them that none but the sick and indolent will say "I am too old to learn." You can, through the proper channels, get an introduction to the R. R. shops in New Jersey, and the first step will be to get some acquaintances there. You would probably be able to earn $1.25 to $1.50 per day, depending upon the amount of interest you would take in the business. L.

(3) C. E., New York City, writes: Please inform me if there is a solution, or something with which I can harden a drill so as to drill a hole into a hardened piece of steel. Also, how small and very fine circular saws for brass and steel work erfectly straight are tempered, so as not to bend or break. A. For drills select the very best steel, heat in a charcoal fire, and do not heat above a cherry red. In tempering, heat to a cherry red, and cool off in a solution composed of the following proportions: Rain water, 2 galls.; corrosive sublimate, 1 oz.; sal-ammoniac, 1 oz.; saltpetre, 1 oz.; rock salt, 1½ pints. (Poison.) To use the drill run slow, and instead of oil use turpentine.

A great deal of practice is required to temper saws successfully. The following solution has been used with good results: Suet, 2 lbs.; beeswax, ¼ lb.; whale oil, 1 gal., boil together. By adding about 1 lb. of black resin to the gallon the steel will be made more hard and brittle, but this is not very often required for saws, and is intended for thicker work. The saws should be heated uniformly in a charcoal furnace and plunged instantly edgewise into the solution. If found too hard draw the temper over a gas flame or spirit lamp. In tempering, saws lose some of their elasticity, which may be restored by hammering, and if they are warped, recource is made to the same process, which is a trade in itself, and requires good judgment and skill.

(4) O. S., Wyandott, writes: I am a reader of your valuable paper, from the first volume and number to the present time. In reading the Practical Method of Setting the Valves of a Locomotive, by Mr. Lewis F. Lyne, I notice a point where he says, as the rods of different engines are of different lengths, and the shorter the rod, the faster the lead will increase. In the experience that I have had on locomotives, I must say that the leads on locomotives valves will diminish instead of increase. I have assisted in setting and squaring a number of locomotive valves. I have seen engines go out of the shop with 3-16 in. lead and when they came in again there was not a 1-32 in. lead left. A. The writer evidently misunderstands the language used in the article, as the length of the rod simply does not control the lead. If he will read the connection carefully, he will see that the idea intended to be conveyed is, that the shorter the eccentric rods, the faster the lead increases as the link is lifted towards the center, owing to the shortening of the radius of the link. The lead alone is adjusted by rolling the eccentric.

(5) J. R., Erie, Pa., writes: Will you be kind enough to tell me through the columns of your paper, the proper way to turn a spindle for a lathe. There was one broke in the shop by the carriage running up when the chuck was on it, and a new one was turned up and to all appearances runs true in the lathe where it was turned up, but as soon as put in its bearings it runs out and keeps getting worse. Do you think it would be caused by putting the new one in where the old one used to run without trueing of the bearings in a lathe? A. To turn up a spindle for a lathe, the workman should take a lathe that is in good order and first true up both centers, first assuring himself that the cups on bearings are tight. Center the spindle with a square center, and then drill a small hole in the center to prevent the point of the lathe center from being broken. Turn up the spindle and then without removing the dog, slip a clamp with a hole in it over the spindle and hold it up against the live center by means of two bolts passing through the face plate, and not too tight. Now put the steady rest on the other end of the spindle and drill the hole for the center, then bore it out with a tool and finish by just scraping with a reamer. If you have no reamer suitable, it will pay to make one of flat steel and put two pieces of wood on it. By this means you will get a good job and a true one. Be particularly careful while you are working the material that all the lost motion is taken up both on the lathe and in the steady rest.

(6) P. B. S., Cincinnati, O,, asks: What is the best fire for tempering steel? A. A clean charcoal, anthracite, or coked bituminous coal fire is required. Such as is fit for taking a forging heat on iron is entirely unfit for hardening purposes. The sulphur contained in the coal combines with the steel to form sulphuret of iron and ruins its texture.

(7) "Machinist," Boston, Mass., writes: Please inform me how I can find the tension of a belt; also what the meaning of the word Tanite is? A. 1st. Multiply 36,000 by the number of horse power, divide the product by the number of feet the belt is to run per minute, divide the quotient by the number of feet or parts of a foot in length of belt contact with the small r drum or pulley, divide this last quotient by 6 and the result is the required width of the belt in inches. 2d. The word Tanite is derived from the Latin word Tanium, and is the trade name of a cement of Emery and some binding material (secret) used as a compound for grinding wheels, disks, laps and other forms.

(8) M. L. R., St. Louis, Mo., writes: How is the proper way to finish a tap or reamer? A. The forgings are got out in the usual way; left to anneal, centered and turned just to remove the scale; then anneal again and turn down to within 1-32 in. of the finishing size; anneal once more and finish in the lathe. If not sprung in the turning the tap or reamer will come out all right when hardened. This has been tested successfully with taps ½ in. in diameter and 3 inches long up to those of 1 in. in diameter and 2 ft. long.

(9) J. W., Mobile, Ala. writes: I would like to know if you could tell me the simplest way of explaining the setting of a valve which cuts off at different points, also, how to place a cam or cams on a steamboat with proppet valves? and also the simplest explanation of the meaning of cut-off, that is to say what is its use? Let me know of some good books on engineering. A. (1) For setting the slid valve we refer you to the article by L. F. Lyne, Vol. 2. No. 1. (2) Construction and adjustment of the cam unless you have the necessary eduction would require too much space to make it plain, and we refer you to Practical Notes on the Steam Engine, by King, U. S. N. (3) Cut-off. That which cuts off or shortens. A contrivance in the steam engine by which the steam is cut off from the passages to the cylinder when the piston has moved through a part of the stroke so as to allow the piston to complete the stroke by the expansive force of the steam already let in. Its object is to economize steam and fuel. For scientific books write to any first class dealer and they will send you a catologue from which you can make your own selections.

Patent Car Mortiser and Borer.

The accompanying illustration shows a No. 6 Large Patent Car Mortiser and Borer, manufactured by J. A. Fay & Co., Cincinnati, Ohio. It is an extra heavy machine, erected from new designs, and adapted for the heaviest description of Car and Bridge work, being capable of cutting a 2½ inch mortise through 16-inch timber.

It is constructed upon a hollow column of very strong section, having a broad base, upon which it stands firmly upon the floor.

It is made entirely of iron and steel, and every part is attached to and supported on the main column, no attachments of weights, treadle, or pulleys to the building being necessary.

The chisel bar has a perfectly graduated stroke, commencing at a still point above the extreme upper throw, and working gradually down into the mortise, with little or no perceptible jar to the foot, under perfect control of the operator, without slides or levers, and with about one half the joints usually employed in machines of this class.

The bed will receive timber up to 17 inches square, and the chisel will beat a mortise to the center of 16 inches and 8 inches deep, or, by changing the face of the stick, it can be made to work clear through.

The bed or table is supported on a central screw, by which means the thrust or blow of the chisel is terminated to the foundation, and does not fall upon the table bracket.

It has two boring attachments: one on a line with the chisel to bore for the mortises, which will bore to 10 inches from the center of column; also, an Adjustable Auxiliary Boring Attachment, for boring bolt holes, which will bore 17-inch stuff.

Each machine is furnished with 9 chisels and 9 augers, to correspond; sizes, ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1⅜, 1½ inches; also, long augers for boring joint bolts, sizes, $\frac{9}{16}$, $\frac{11}{16}$, $\frac{13}{16}$. Other sizes can be furnished, as may be wanted.

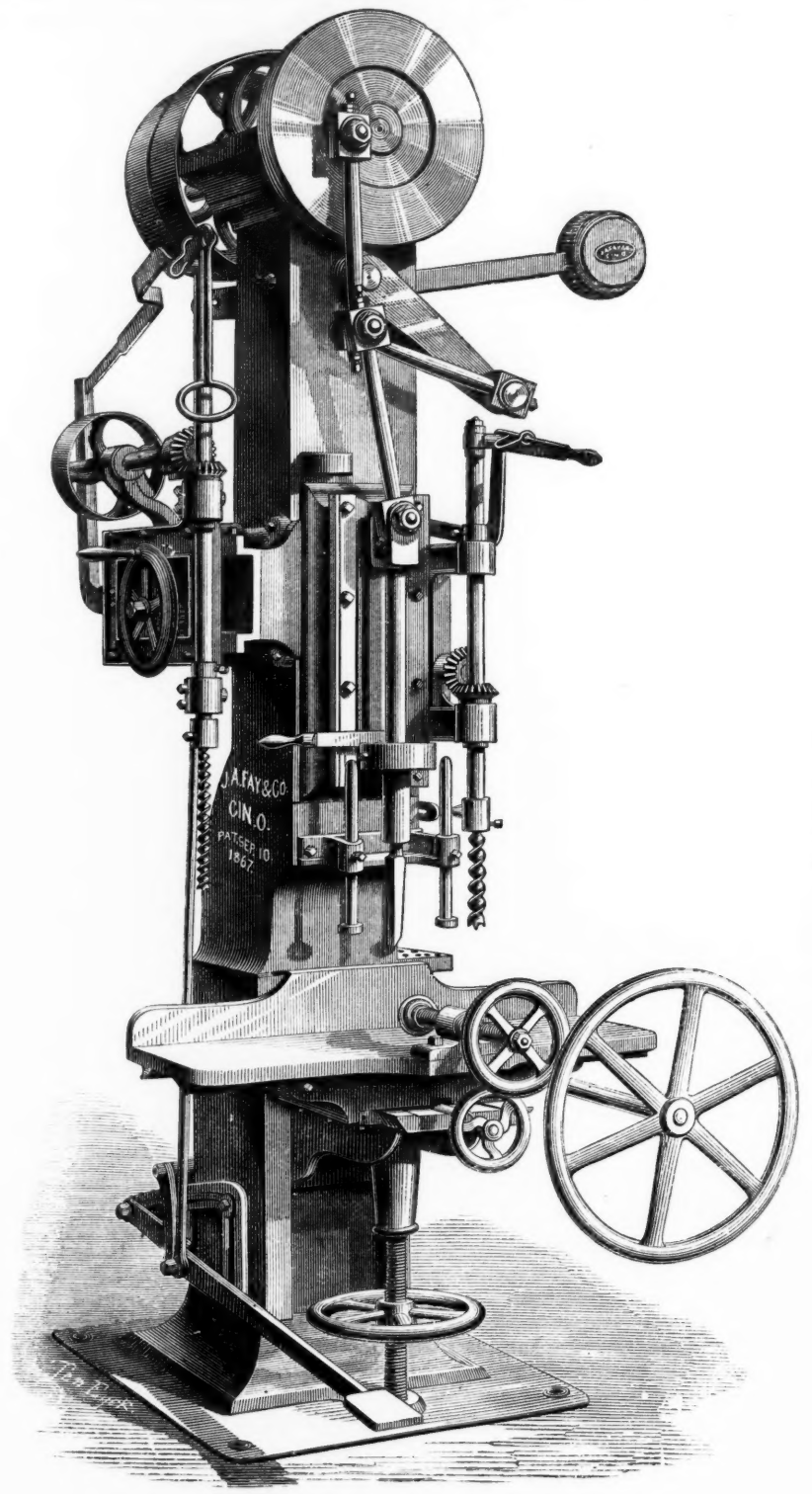
A countershaft for driving the auxiliary Boring Attachment is also supplied with each machine without charge.

Especial attention is called to the fact that every joint in the graduated movement is bored and turned, and is compensating, while there is not a piece that will not last years with care and skillful use.

They are in use in many of the largest railroad and car shops in the country, and are warranted to give the highest satisfaction.

The tight and loose pulleys are 16 inches in diameter, and 4-inch face, and should make 275 revolutions per minute.

They are for sale by the George Place Machinery Agency, 121 Chambers St., and 103 Reade St, New York.



NEW CAR MORTISER AND BORER.

Possibilities in Economy of Steam Power.

Referring to the indicator diagram shown on page 5 of Jan. No. of AMERICAN MACHINIST, we will complete an analysis that we had not time to complete last month. And right here permit us to say that this diagram was first published by the writer in 1874, and has since been quite extensively copied without due credit, doubtlessly owing to the obscurity of its modest author--Smoke.

But to our subject. The dotted line from A to B represents the boiler pressure, and from B to C the theoretical expansion curve. The line marked o o is the atmospheric line. The steam valve opens just as the crank is passing the center, at the commencement of the stroke, or the pressure of steam on the piston approaches close to the boiler pressure; but as the speed of the piston is accelerated it gradually decreases to the point of cut-off b. From b to c the actual expansion curve approaches remarkably close to the theoretical expansion curve. At c the exhaust valve opens and the pressure drops to 1.75 lbs. which is steadily maintained until the piston reaches e; then the exhaust valve closes and the steam remaining in the cylinder is compressed, until the crank reaches the dead center when the steam valve opens again and another stroke is commenced. The line from d to e is called the line of counter pressure, while the line from e to f is the compression line, and deserves special consideration. If it is excessive it occasions a loss of power, while without it a quick speed cannot be maintained without considerable noise, to say nothing of hot journals, etc.

The practical application of the theoretical expansion curve is, that if the steam valve leaks and the piston is tight, the actual will be above the theoretical curve. On the other hand if the valve is tight and the piston leaks the actual curve will run below the theoretical curve.

Assuming 10,000 heat units per pound of coal consumed, as the efficiency of the boiler used in connection with the engine from which the diagram was taken, we have 10,000 ×772=7,720,000 foot pounds, and 7,720,000 +33,000=233.93 and 233.93÷60=3.89 H. P. per hour as the theoretical value of the steam furnished by the boiler; but in place of getting 3.89 H. P. per pound of coal we use 4.1 lbs. coal per H. P.—quite a difference truly, and the question is, where does this great loss come in, and what can be done to stop it?

First, there is priming which carries away quite a percentage of heat without any equivalent in work. Then there is the cylinder condensation which is another source of loss; but these losses can readily be prevented by a proper amount of superheating.

At the point C of the diagram it will be noticed that the steam urging the piston has dropped to 4 lbs. above the atmosphere, at which pressure the exhaust valve opens and the steam escapes, without doing further work in the cylinder. As each lb. of steam at 4 lbs. pressure contains within a fraction of 1183 heat-units, it follows that from each lb. of steam we have admitted to the cylinder, under a pressure of 70 lbs., by gauge, we have only extracted 1210—1183=27 heat-units! We might use a portion of the heat remaining in the steam to heat our feed water; in this way we save some 170 heat-units per lb. of steam. While this would represent a saving of 17 per cent. of coal, as compared with feed water of, say, 42° and 212°, yet it would leave 1013 heat-units as still lost through the exhaust, and as there does not seem to be any practical way of constructing an engine without the exhaust, it is quite evident that we cannot expect to get a very large percentage of the theoretical value of the coal in our every day practice. It will be seen from this, that while the comparison of the actual duty of even our best engines with the theoretical value of the coal is not flattering to our vanity, yet, when we come to compare the cost of power among factories, etc., we see, in many cases, a large margin for improvement.

But to return to the question of priming and cylinder condensation. What may we expect to gain by a moderate degree of superheating? In a paper read before the Society of Arts, at the Massachusetts Institute of Technology, at Boston, Prof. George Basil Dilwell says that "an amount of fuel, used in super-heating, will do three and a half times the work that the same fuel can do in forming ordinary steam from water."

Again, in an experiment made by Chief Engineer Isherwood, with a cut-off of 29 per cent., and without super-heating, a H. P. cost 32.75 lbs. of water, and 4 lbs. of coal—while with a cut-off of 28 per cent., and with superheated steam, a H. P. cost but 16.4 lbs. of water and 2.2 lbs. of coal. Again, take the "Corliss Pawtucket Pumping Engine," (and, by the way, our object in selecting this engine is because it presents greater attention to details than any other engine that has come under our personal notice, as well as because its economical features can, and doubtless will, be applied to mill engines) it will be seen that steam of high pressure and temperature, 125 lbs. by gauge, and super-heated, is used; and this, doubtless, is one of the points that to help roll up its splendid duty.

That a distinction should be made between indicated and transmitted power is evident, as there are many engines throughout the country, in which the friction of the engine is at least 20 per cent. of the gross load that it drives; and here is another loss that should receive serious consideration.

However, these brief examples will suffice to show the necessity of having all the water supplied to the boilers evaporated into, at least, throughly dry steam before it is passed over to the engine; and, we can see no reason why, with proper care in super-heating, our single cylinder engines cannot be made to give as good duty as many of the compound engines of the present day. We admit that, in order to get the benefits of this feature, it will not be possible for a man to "run" a 100 H. P. engine, do his own firing, make hat boxes, and do the carpenter work of the mill, besides run of errands, etc.; but still we think it will pay; for after all, the efficiency of any engine department will depend, in a great measure, upon the skill of the engineer in charge. And until mill owners, and others interested in producing power with economy, wake up to this fact, we may not expect to see any very brilliant work in the engine room. This is one of the comedies of business—that men who are extremely careful of office expenses, who look after every little scrap of paper and postage stamp, will, without any apparent concern, allow a leak in the engine room that is, in many cases, sufficient to swamp a good business.

W. H. ODELL.

YONKERS, Feb. 6th, 1879,

Machinists' and Engineers' Supplies.

There is a fair volume of trade in the aggregate, but business is done, as a rule, on small margins of profit. Purchasers make frequent orders, and seldom in large quantities. The prevailing mania seems to be to buy cheap, and most purchasers are open to receive proposals some length of time before giving even a moderate order. The downward tendency of prices seems to have been arrested, and there is a growing demand for a better class of goods than were formerly salable.

The Brown & Sharpe M'f'g. Co., and Darling, Brown & Sharpe, Providence, R. I., issue, under date of January 1st, a new catalogue and price-list of 100 pages, pocket form. It contains engravings of their machinery and tools, with descriptions; also, valuable tables for machinists using their tools. We notice a number of additions since the publication of their last catalogue. Their standard gauges and tools for accurate measurement occupy an important place in the best and most successful machine shops throughout our country, also in many of the most progressive shops of Europe. A reduced price-list is given on their celebrated patent cutters for the teeth of gear wheels, which can be sharpened by grinding without changing their form.

Messrs. E. E. Garvin & Co., 139 Centre St., New York, issue a new catalogue of light and heavy milling machines, drill presses, hand lathes and ta ping machines. They have fitted up a well-appointed shop, and make an excellent line of machinists' tools.

The Dixon Crucible Co. of Jersey City, have reduced the price of their dry plumbago "Perfect Lubricator" to 20 cents a pound, and are selling their "Everlasting Axle Greese" at 10 cents a pound. The latter is applicable to both wooden and metallic machinery bearings. It will not stiffen in winter nor soften in summer enough to prevent its proper use. Perhaps the best evidence in favor of the latter is that, notwithstanding their great capacity, they are hardly able to keep up to their orders for it.

There is considerable demand for small chucks for foot lathes, and mechanical genius has been taxed to a great degree to meet this demand. The latest small chuck offered to the trade is the "Trump," made by Trump Bros., Wilmington, Del. It has three jaws, and is self-centering. Two sizes are made, selling at $1.50 and $2.25, respectively. One takes drills up to ⅛ inch, and the other to ¼ inch.

BOILER MAKERS' SUPPLIES.—There is some improvement in demand, and prices are maintained as before. Prices for Stove Tank iron 2¾c.; C.H. No. 1, 3¼c.; C. No. 1, 3c.; best flange, 4½c.; best flange fire box, 5c.; Eureka flange, 6c.; Eureka fire box, 7c.; boiler rivets, 3¾c.; boiler tubes 40% discount from list.

FILERS' TOOLS AND SPECIALTIES,

CONSISTING OF

PATENTED HOLDERS FOR

Surface Filing.
True Vise Filing,
Stove Plate and
Pattern Work Filing, also
Bent Rifflers,
Machinists' Scrapers,
File Brushes AND
File Cards.

IN CONNECTION WITH

FILES AND RASPS OF EVERY DESCRIPTION,

Manufactured only by the

NICHOLSON FILE CO.

PROVIDENCE, R. I.

NOTE.—Our "Treatise on Files and Rasps" (price $1.50) will be furnished our customers free with first goods sent them.

Patent Automatic Cut-Off Steam Engine.

WM. WRIGHT,

PATENTEE AND BUILDER, NEWBURGH, N. Y.

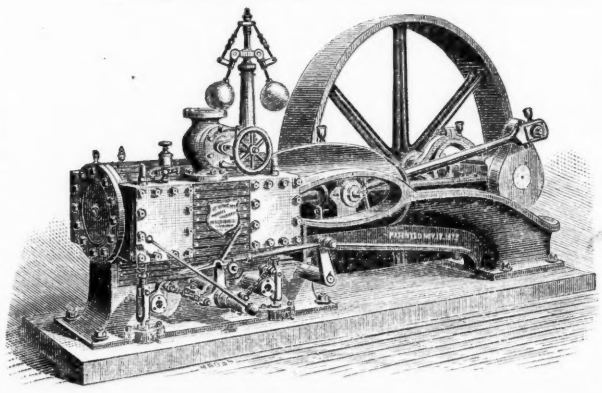
The Most Economical in the Use of Fuel,
The Simplest in Construction, and
Altogether the Best Cut-Off Engine in Market.

Compound Engines

For City Water Works; also for Manufacturi n g purposes, etc.

(*highest duty guaranteed.*)

MARINE AND STATIONARY ENGINES.



Steam Boilers AND **Tanks,**

LIGHT AND HEAVY FORGINGS, SHAFTING, PULLEYS HANGERS, MILL WORK, IRON AND BRASS CASTINGS, &c.

A LARGE GENERAL ASSORTMENT OF PATTERNS ON HAND.

THE BEST STEAM PUMP in AMERICA

THE DEANE.

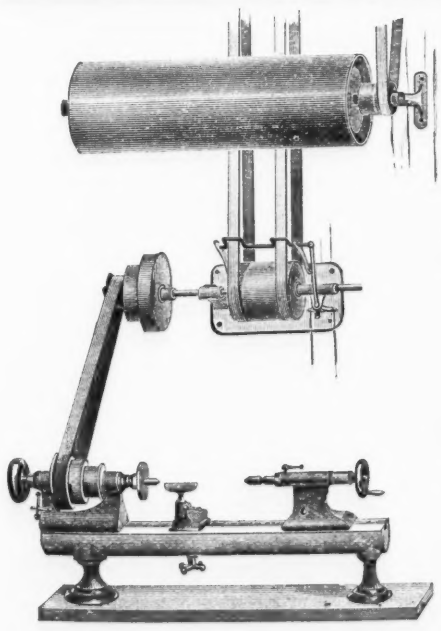
Made by the Holyoke Machine Co.

MORE THAN 4,500 IN USE, JANUARY, 1879.

Send for Reduced Price List.

DEANE STEAM PUMP WORKS,

85 Liberty Street, - New York.



American Watch Tool Co.,

WALTHAM, MASS.

P. O. Box 999.

MANUFACTURERS OF

MACHINERY

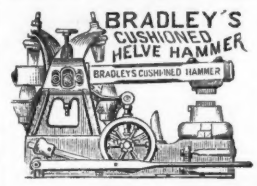
FOR

WATCH AND CLOCK MAKING

AND

Special Tools and Machinery of all kinds.

The above cut shows our No. 3, or Machinist Bench Lathe, with its driving counters for lathe, and its grinding attachments. This lathe was originally de igned for the American Watch Co., and has been adopted by all American watch companies and by many clock companies of this country, and watch companies of England and Switzerland. All agree in pronouncing it the best Lathe for small work ever made.



Bradley's Cushioned Helve Hammer

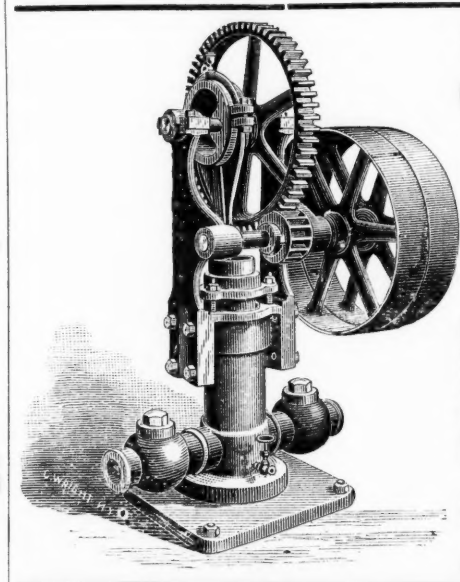
Awarded first premium, Silver Medal at American Institute Fair, 1873, Cincinnati Industrial Exposition, 1874, and the Diploma of Honor and Grand Medal of Merit at the Centennial Exhibition in 1876,
Being the highest award given any goods of their class in America or Europe.

IT HAS MORE GOOD POINTS,
LESS COMPLICATION,
MORE ADAPTABILITY,
LARGER CAPACITY.
DOES MORE AND BETTER WORK,
TAKES LESS POWER,
COSTS LESS FOR REPAIRS
than any Hammer in the World.

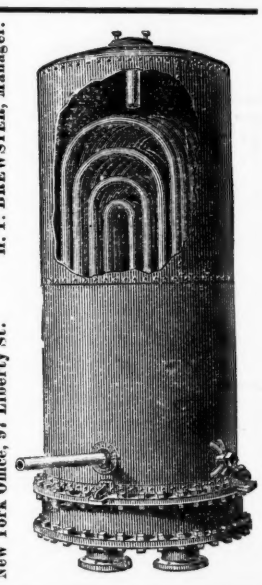
Guaranteed as Represented.

A. B. BARNES, Western Agent.
Nos. 24 & 26 South Canal Street,
CHICAGO, ILL.

BRADLEY & COMPANY,
[Established 1832.] *SYRACUSE, N. Y.*



I. B. DAVIS, HARTFORD, CONN.
Manufacturer of the
Berryman Patent Fe d Water Heater and Purifier
AND ECONOMIC FEED PUMP.
This Pump is designed for use where cheapness in first cost, economy in running and great durability are required.
New York Office, 97 Liberty St. H. T. BREWSTER, Manager.



Newell's Patent Universal Grinder.

IMPORTANT TO MILLERS, MINERS AND MANUFACTURERS.

This Grinder is offered to the public as a machine which has no equal for grinding grain or pulverizing quartz, phosphates, bone, cement, oyster shells, scraps, glue, fire clay, and other articles of similar nature. It is unrivaled in the amount of work it will do in any given time and in the economy of power used. It is a point of great merit that our mill delivers a perfectly ***GRANULATED*** article. In grinding grain the meal ***IS NOT HEATED,*** and consequently may be bagged at the delivery spout with no danger of fermentation, and without the loss of weight incidental to the product when heated in grinding. It is estimated that the usual shrinkage is sufficient to cover the entire expense of grinding by this mill. We have ground, bolted for fine feed, through 13 mesh, weighed and bagged up ***six thousand five hundred (6500) pounds of corn per hour*** with not more than 15-horse power. It is compact, portable and not expensive. A cordial invitation is extended to all parties to call and see the machine at work at the foot of

West 19th Street, New York City.

NEWELL & CHAPIN.

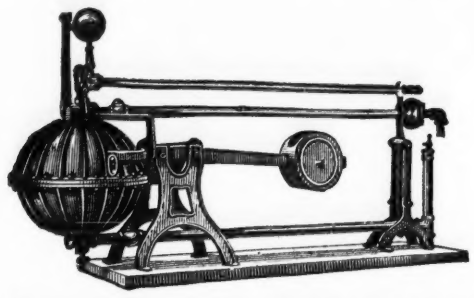
Clark's Patent Rubber Castor and Truck Wheel,

Especially desirable in Hotels, Warehouses, Mills, &c., being noiseless in their action, and saving all wearing away of floors.

GEO. P. CLARK,

Send for Price List and Circular. **WINDSOR LOCKS, Conn.**

THE ALBANY STEAM TRAP.



This Trap automatically drains the water of condensation from HEATING COILS, and returns the same to the Boiler, whether the Coils are *above or below* the water level in Boiler, thus doing away with pumps and other mechanical devices for such purposes. Apply to

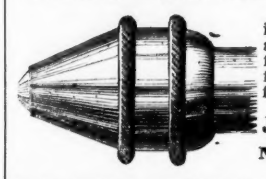
Albany Steam Trap Co.,
ALBANY, N. Y.

STEELINE.

Used for refining and tempering all kinds of Steel Tools. Increases their durability at least five fold. Secures absolute safety from cracking. Adds greatly to the tensile strength of tools and steel.
Send for circular to

BAUER & CO.,
96 Greenwich Avenue, N. Y.

PERFECTION CHUCK.



Four Steel Jaws. Four inch turned shank to fit any lathe. It will take from smallest drill to a full 3-16. Warranted fully. Price, $1.50.

JAMES D. FOOT,
No. 40 Broadway
New York.

Sent by mail on receipt of price.

FRASSE & CO.

62 Chatham St., New York,

P. O. BOX 4627,

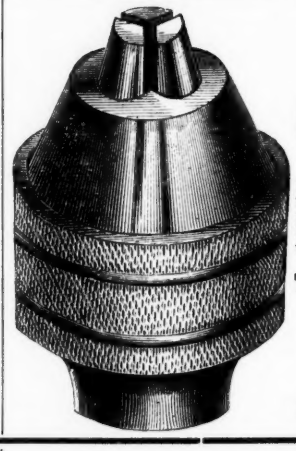
Have the best assortment of sizes and threads in

Taps AND Dies

For Machine Screws of any house in this country.

ALSO,

A Full line of Machinists' Tools & Supplies.



ALMOND
DRILL
CHUCK

Made of Steel throughout, equal to doing any work required of it—Runs perfectly true. Cost but $5.

T.R. ALMOND
84 Pearl St.
BROOKLYN.

(Cut shows Chuck full size.)

THOS. PROSSER & SON,
15 Gold St., NEW YORK.

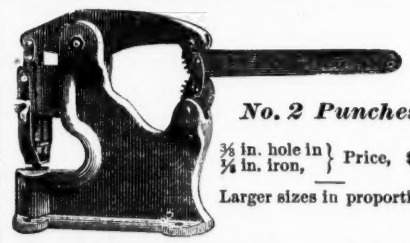
"Prosser" Boiler Tube Expanders

STEEL SCREW PUNCHES, TUBE BRUSHES, &C.

KENNEDY'S

Concentrated Power

Shearing AND Punching Machines



No. 2 Punches,

3/8 in. hole in 1/4 in. iron, } Price, $25.

Larger sizes in proportion.

These tools are portable, and easily worked by one man; handles are reversible, and can be adjusted to run by foot power. The Punching Machines are furnished with the patent Spiral Punch, which does not mutilate the iron and requires less power. The Flange Punch, "Screw Punch" and "Railroad Punch"—for 1 1/8 in. hole in railroad bar—are the most perfect tools in the market.

For further particulars, address the manufacturers,

C. H. DELAMATER & CO.,
New York.

Salesroom, 10 Cortlandt Street.

Engines Indicated and Examined.

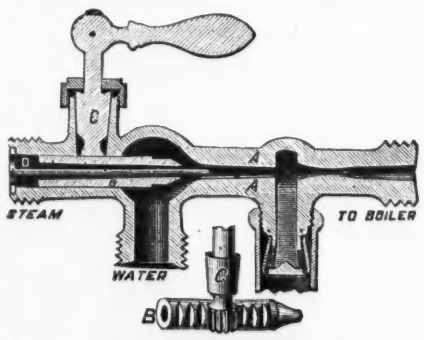
POWER MEASURED.

W. H. ODELL, Practical Engineer.

P. O. BOX 274, YONKERS, N. Y.

N. B.—The application of the "Indicator" to an Engine (by an Expert) instantly detects any waste of power, or defect in the CONSTRUCTION or MANAGEMENT OF THE SAME, and often leads to a great saving of fuel.

The Keystone Injector



Cheapest and best known Boiler Feeder in the market. Its advantages over all others are its *Simplicity*. It is not affected by over-heating. It has no Packing and Stuffing Boxes. No extra fittings required for *Lifting* and *non-Lifting* Injectors. Manufactured by

E. TRACY,
1510 & 1512 SPRING GARDEN ST.,
PHILADEPHIA, Pa.

Send for Circular and say where you saw this.

TRADE GODDARD MARK

THE
Goddard Emery Wheel,

E. A. GODDARD,
Gen. Sales Agent.

ALSO AGENT FOR

AMERICAN TWIST DRILL CO'S
Emery Grinders.

DEALER IN

MACHINISTS' SUPPLIES.

Warerooms, 176 FULTON STREET, NEW YORK.

THE HENDY MACHINE CO.

WOLCOTTVILLE, CONN., U. S. A.

MANUFACTURERS OF THE

Manville Patent Iron Planers and Shapers.

ALSO, RIVET MACHINES, LATHES, SLITTING MACHINES, NEEDLE MACHINERY, &c., &c.

HAY, COTTON, LARD, CLOTH, PAPER AND BOOK BINDER'S PRESSES UNDER EDMONDS' PATENTS.

SEND FOR CATALOGUE,
And mention where you saw this.

PATENTS.

HENRY E. ROEDER,

304 Broadway, New York.

ESTABLISHED 1852.

Patents procured in the U.S. & Europe.

NORTON'S
Solid Emery Wheel.

The Best Solid Wheel in use. Will not Glaze, Heat, nor smell, and will run equally well, Wet or Dry.

SATISFACTION GUARANTEED OR NO PAY.

F. B. NORTON, Patentee and Manufacturer,
No. 41 Water Street, Worcester, Mass.

PATENTS

F. A. LEHMANN, Solicitor of Patents, Washington, D.C.
NO PATENT NO PAY. *Send for Circular.*

Established 1849.

Iron Planers

A SPECIALTY.

C. WHITCOMB & CO.

Manufacturers,

WORCESTER, Mass.

Orders Solicited.

1879.

THE
Chicago Journal of Commerce
AND PRICE CURRENT

A Five-Column Quarto of 24 Pages.

The Largest, Most Reliable, and Best Commercial Paper published in the West.

ESTABLISHED FEBRUARY, 1863.

No Country Merchant can afford to be without it. To them its Weekly Review of the Markets, alone, is worth much more than the cost of the paper.

It enjoys the unlimited confidence of the manufacturing and jobbing interests of the Northwest.

Its bona-fide circulation is greater than that of any other commercial paper in the West.

It circulates in almost every town and village in the following States and Territories:

ILLINOIS,	MONTANA,
IOWA.	IDAHO.
WISCONSIN.	NEVADA
MICHIGAN.	UTAH.
OHIO.	TEXAS.
INDIANA,	NEW MEXICO.
MISSOURI.	OREGON.
KANSAS.	DAKOTAH.
ARKANSAS.	WYOMING.
MINNESOTA.	COLORADO.
NEBRASKA.	WASHINGTON

CALIFORNIA.

In addition to these States, it has many subscribers in more Eastern and Southern States.

As a Medium for Advertisers the JOURNAL stands unrivaled.

Sample copies sent gratuitously, upon application.

Terms of Subscription, $3.00 per Year,
PAYABLE IN ADVANCE.

Address

JOURNAL OF COMMERCE CO.
70 State Street, Chicago.

Address P. O. Box 2187.

PIERSON & CO.

Office 24 Broadway, N. Y.

Established 1790.

IMPORTERS AND DEALERS IN IRON AND STEEL OF EVERY DESCRIPTION,

Warehouse, 24 and 26 Broadway, and 77 and 79 New Street,

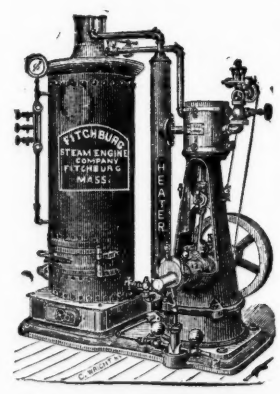
PRICE LISTS FURNISHED ON APPLICATION.

REVIEW.

NEW YORK, FEBRUARY 15TH, 1879.

There is more inquiry and increased consumption, while the low prices for manufactured iron prevailing, and advance in raw material, has precluded any concessions to buyers on the part of the mills, and as there is little or no profit at present prices to the jobber, and the chances favor higher rates out of store here.

PIERSON & CO., 24 BROADWAY.



STEAM ENGINES

Vertical or Horizontal.

Combined, as in cut, 2 to 12 H. P., or on independent beds, **2 H. P.** upwards to **200 H. P.** ***Plain*** or with ***Automatic Variable Cut-off.*** We can refer to hundreds in use, of all sizes, giving perfect satisfaction.

Yacht Engines and Steel Boilers, Shafting, Pulleys, Hangers, &c.

Send for pamphlet, stating where you saw this, to

Fitchburg Steam Engine Co.

Fitchburg, Mass., U. S. A.

Sandford's Patent Safety Screw-Hoisting Machine,

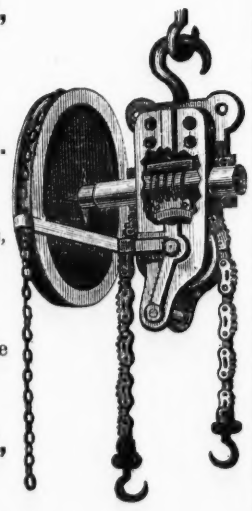
MANUFACTURED BY

Elizabethport Mf'g Company,

S. PARK LATHROP,

Sole Wholesale Agent for U. S.

200 Market Street, Newark, N. J.



For use in Machine Shops, Mills, Steamships, &c., they are invaluable.

ONE MAN

can lift from 2,000 to 10,000 lbs. They are

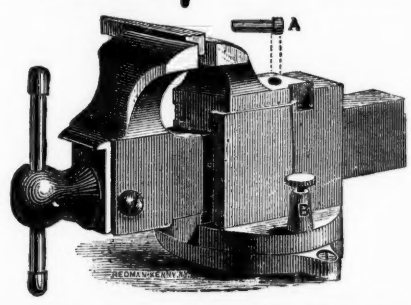
DURABLE, CHEAP, COMPACT, SIMPLE, AND SAFE.

Can not run down of itself. Can be worked at any angle. Send for Price-List and Catalogue.

PRENTISS' PATENT

Adjustable Jaw Stationary and Swivel Bottom Vises.

COMBINING SIMPLICITY,



STRENGTH AND DURABILITY.

Without attachment the most complete Vise in Use. Adapted to all classes of Vise Work.

MANUFACTURED BY

BAGLEY & SEWELL, General Machinists, Watertown, N.Y.

FOR

HALL MANUFACTURING CO.

Send for Circular. ***23 DEY STREET, N. Y.***

WANTED.

Two Good Vise Hands

ACCUSTOMED TO FITTING UP MACHINE TOOLS.

Steady Employment to the Right Men.

Niles Tool Works,

HAMILTON, O.

FOR AUTOMATIC CUT-OFF FIXED CUT-OFF & SLIDE-VALVE

STEAM ENGINES

ALSO BOILERS ADDRESS WOODBURY BOOTH & PRYOR, ROCHESTER, N.Y.

BABCOCK & WILCOX,

Water-Tube Steam Boiler.

OVER 30,000 HORSE-POWER NOW IN USE.

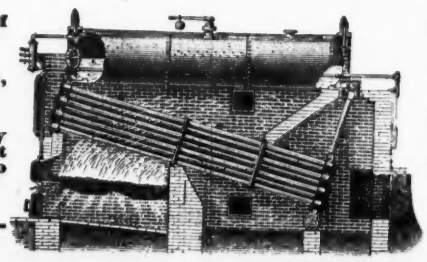
ADAPTED FOR ALL PURPOSES.

In Sections Easy of Transportation.

No Bolted, Screwed, or Packed Joints.

All Joints made by Expanding Wrought Iron Tubes into Bored Holes.

Can be erected or repaired by ordinary mechanic.



Easily cleaned from Soot or Sediment.

Adapted to all kinds of Fuel.

Steady Water-Line and Dry Steam.

No Leaks from Unequal Expansion.

Rapid Steaming.

Highest Attainable Economy.

CENTENNIAL EXPOSITION MEDAL AWARDED THIS BOILER FOR HIGHEST ECONOMY AND EFFICIENCY ON TEST.

Illustrated circulars and other information desired promptly furnished.

BABCOCK & WILCOX, Engineers,

30 COURTLANDT STREET, NEW YORK.

MIDVALE STEEL WORKS

NICETOWN, PHILADELPHIA.

Manufacturers of all Kinds of

Hammered and Rolled Steel,

BEST WARRANTED CAST STEEL

For Machinists' Tools, Taps, Punches, Dies, Drills, Chisels, Shear Blades and Granite Drills.

ALSO,

Machinery, File, Fork, Hoe and Spring Cast Steel.

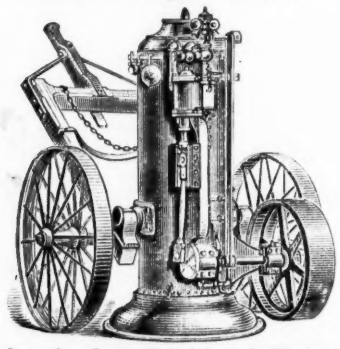
Address A. M. F. WATSON,

General Sales Agent.

Warehouse, 12 North 5th Street, Philadelphia.

THE TRADE ENGINE.

Proved to be the **BEST** and **MOST ECONOMICAL** Small Power Engine in the U. S.



None but the Best Material and Workmanship employed.

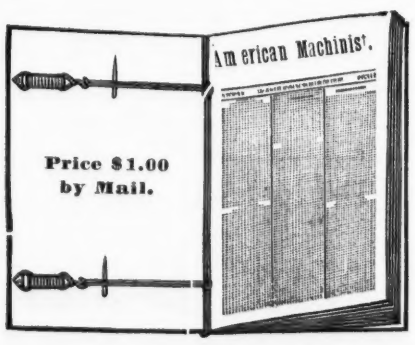
Trade Engine Works,

☞Send for Prices. *DAYTON, O.*

BINDERS

FOR THE

AMERICAN MACHINIST.



We are now prepared to offer to our readers who wish to preserve files of the paper the

Monitor Binder,

shown in the above cut which we have selected as the best one offered to the public. The price for neat cloth covers, to hold 24 numbers (2 years), with the name **American Machinist** stamped on the front (outside), will be $1.00 each, mailed post paid in the United States and Canada, and 75 cents each delivered at our office, 75 Fulton Street.

MILLER & BAILEY,

Editors and Proprietors.

THOMAS D. STETSON,

SOLICITOR OF PATENTS,

AND MECHANICAL EXPERT IN PATENT CASES,

No. 23 MURRAY ST., New York.

(House 950 Lexington ave., near 69th street)

Respectfully offers professional assistance in Caveating; Searching on Novelty; Securing Patents in this country; Contesting Interferences; Arguing Rejected Applications; Preparing Assignments and Licenses; Reissuing; Extending; Advising on Validity, Scope, Infringements; Examining if clear of previous Patents; Protecting Æsthetic Devices—Designs; Protecting Commercial Devices - Trade Marks and Labels; Assisting in Contests on Patents and Trade Marks; Testifying in the Courts in Patent Proceedings; Securing Patents in foreign countries; Counseling at all stages on Exclusive Rights.

He asks increased business on the following grounds;

Special Adaptation,	Moderate Charges,
Mechanical Training,	Modern Facilities,
Successful Experience,	Central Location,
Personal Attention,	Good Assistants.

Mr. Stetson represented Messrs. Fairbanks in extending the Railroad Track Scale patent, Sir William Thompson in patenting the Atlantic Telegraph Instrument, and Mr. Corliss in patenting he novelties in the Centennial Exhibition Engine. He will advise candidly on any business undertaken. Will come personally to your shop if desired. Is at the U. S. Patent Office every few weeks.

Has special indexes and abstracts in many branches of the arts, accumulated as the results of former labors. Has a series of Directories for tracing witnesses, and capacious storage room for models and exhibits.

Agent in England, Mr. W. Lloyd Wise, 22 Buckingham St., Adelphi, London, W. C

ENGRAVING

—ON—

WOOD.

Thirty Years of Practical Experience in all its Branches.

For Specimens of Mechanical Branch see this paper.

R. S. BROSS,

15 & 16 Ann Street,

NEW YORK.

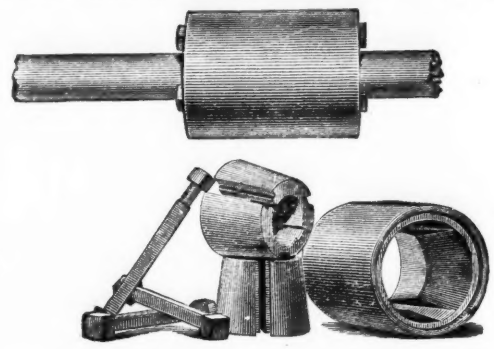
ESTABLISHED 1848.

WILLIAM SELLERS & CO.

PHILADELPHIA.

Machine & Railway Shop Equipments

Shafts, Couplings, Hangers, Pulleys, Mill Gearing, Etc.



Lathes, Planers, Drills, Shapers. Bolt Cutters, Etc.

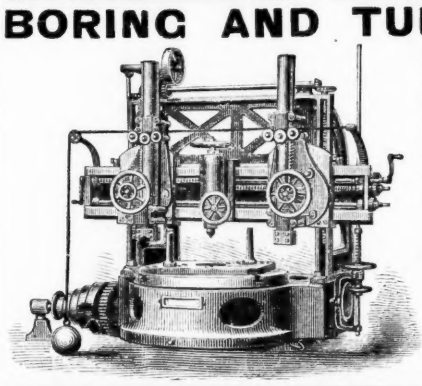
Railway Turntables and Pivot Bridges,

HIFFARD INJECTORS. SELLERS' IMPROVEMENTS

NEW PATTERNS. SIMPLE, EFFECTIVE.

New York Office, 79 Liberty Street.

BORING AND TURNING MACHINES.



Special Pulley Turning Machinery,
Engine Lathes, Iron Planers,
Universal Radial Drilling Machines,
Hydrostatic Presses,
Car Axle Lathes and Wheel Borers.

Manufacturers of General Iron Working Tools. Latest designs and patterns. Prices very reasonable.

NILES TOOL WORKS,

HAMILTON, OHIO.

Founded by Matthew Carey, 1785.

BAIRD'S BOOKS

FOR PRACTICAL MEN.

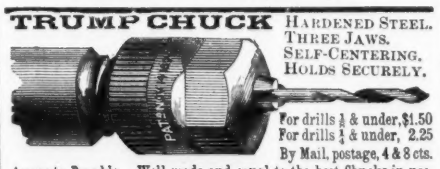
To our business of Industrial Publishers, we have added that of Industrial Booksellers and Importers and have now on hand a valuable stock of English and American Practical and Scientific Books, including the most recent issues from the English and American press.

☞ Our New and Enlarged Catalogue of Practical and Scientific Books—96 pages, 8vo—sent free to any one who will furnish his address.

☞ Two New Catalogues of Books and Pamphlets on Social Science, Political Economy, the Finances, Banking, Population, Pauperism, Political Biography, and kindred subjects, comprising a most extensive and valuable collection Sent free upon application.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers and Importers,
810 Walnut Street, Philadelphia

TRUMP CHUCK Hardened Steel. Three Jaws. Self-Centering. Holds Securely.



For drills ⅜ & under, $1.50
For drills ½ & under, 2.25
By Mail, postage, 4 & 8 cts.

Accurate, Durable. Well made and equal to the best Chucks in use.

TRUMP BROS., Mfrs., Wilmington, Del., U. S. A.

FOR READING, *Writing,* OR DRAWING.

THE OFFICE, *Library,* SITTING ROOM OR *Academy.*

PRICE, FROM $6 to $20

Address M. P. HIGGINS,

Superintendent of the Washburn Machine Shop.

Send for Circular. **WORCESTER, Mass.**

JOHN ADT,

20, 22, 24 and 26 Artisan St., New Haven, Ct., U.S.

Automatic Machines,

For Straightening and Cutting Wire of all Sizes to any Length.

Automatic Machines for cutting and forming wire in various shapes. Send for circulars.

Practical Publications for Machinists.

Treatise on the Steam Engine Indicator...Price	$1.00
American Standard of Bolts and Nuts..... "	1.00
Lyman's Gear Chart..... "	.50
Universal Screw Cutting Index and Rule for Compound Gearing.....	.10

Any of the above sent by mail, postage prepaid, on receipt of price.

Address E. LYMAN, C. E., New Haven, Conn.

BEST AND CHEAPEST FOOT POWER SCREW CUTTING **ENGINE LATHES**

SEE FULL DESCRIPTION IN OCTOBER NO. AM. MACHINIST.

SEND FOR ILLUSTRATED CATALOGUE

GOODNOW & WIGHTMAN

176 WASHINGTON ST BOSTON MASS.

PATTERN AND BRAND LETTERS.

VANDERBURGH, WELLS & CO.

Printers' and Engravers' Warehouse,

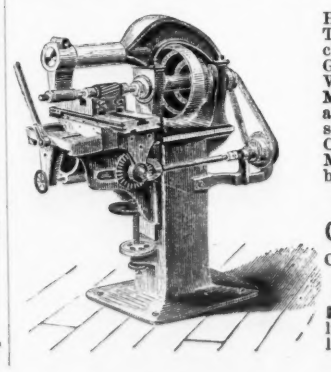
Corner Fulton and Dutch Sts.,

NEW YORK.

E. E. GARVIN & CO.

Manufacturers of

Milling Machines, Drill Presses,



Hand Lathes, Tapping Machines, Cutter Grinders and Wood Planers. Milling Cutters all shapes and sizes. Gear Cutting and Milling in all its branches.

139-143 CENTRE ST

Cornell's B'ld'g,

NEW YORK.

☞ Send for illustrated Catalogue.

The Buckeye Automatic Cut-off Engine.

ILLUSTRATED TREATISES AND ESTIMATES FURNISHED ON APPLICATION.

BUCKEYE ENGINE CO., 87 LIBERTY STREET, NEW YORK.

HILL, CLARKE & CO., New England Agents, 36 & 38 Oliver Street, Boston.

The George Place Machinery Agency,

Sole Agents for J. A. FAY & CO.

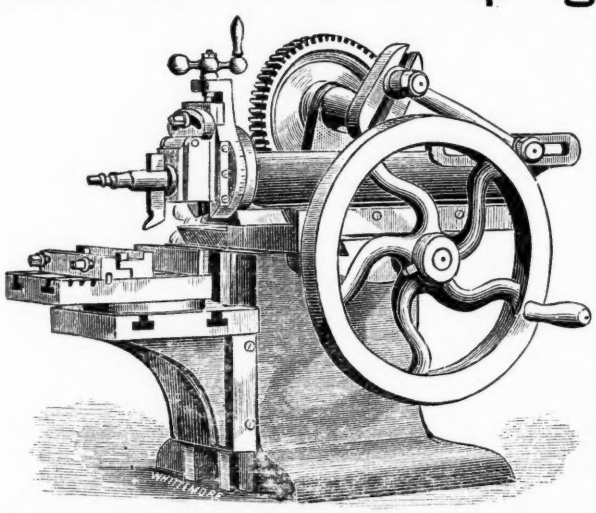
WOOD-WORKING MACHINERY.

Patent Sash, Moulding, Tenoning, Boring, Mortising, Planing and Matching Machinery; Band, Scroll, Ripping, Railway and Carriage Cutting off Saws, Band and Vertical Re-sawing Machinery, etc.

IRON MACHINERY OF EVERY DESCRIPTION. PATENT COLD ROLLED SHAFTING, PULLEYS, HANGERS, ETC.

121 Chambers & 103 Reade Streets, New York.

Hand & Power Shaping Machines.

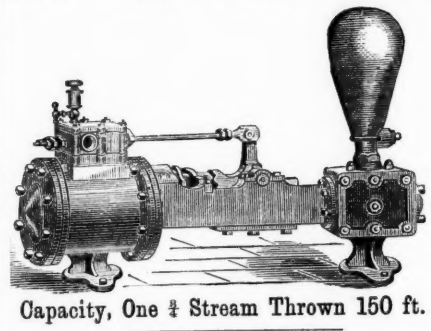


This machine has a stroke of six inches, and may readily be adjusted to work of any less distance. Length of traverse, eight inches. Vertical adjustment of table, three inches. Can be run by hand or power. **Weight, 225 lbs.**

These machines are nicely designed, well made and firm, and will carry a heavy chip. The Packings, Driving Shaft and Feed Screws are of Steel. The Sliding parts are all well fitted by scraping. The Screws and other parts, where necessary, are case hardened. The head is indexed for planing bevels, and is in every respect a first-class and a very desirable tool. Centers will be furnished to go with Shaper when wanted, which will be found very useful in Fluting Reamers, Taps, &c. Also manufacturers of Upright and Horizontal Self-Feeding Drills, Combined Breast and Feed Drills, Hand Bolt Cutters, Patent Tire Benders, and Tools adapted to Blacksmiths and Carriage makers. Circulars and Price Lists to be had upon application.

E. N. BOYNTON, Manufacturer,
WORCESTER, Mass., U. S. A.

OUR NEW FIRE PUMP.



Capacity, One ¾ Stream Thrown 150 ft.

IMPORTANT MPROVEMENTS.

ENTIRELY NEW PATTERNS.

BY FAR THE BEST PUMP MADE.
PRICES T SUIT THE TIMES

☞ Send for Illustrated Catalogue of Steam Pumps and Hydraulic Machinery of every description and for every purpose.

SMITH, VAILE & CO., Dayton, O.

WONDERFUL PUNCHING.

A perfect revolution in punching is made by the use of

D. L. KENNEDY'S

Spiral Shearing Punch.

HALF the present required power is SAVED, and the Drill and revolving cutter for boilers and flue plates are almost entirely superseded.

As this Punch does not mutilate or impair the strength of the iron, no Boiler, Bridge, or any iron work where SAFETY is important should be done with any other.

It can be used in any punching machine, and licenses for that purpose can be purchased very reasonably by addressing the patentee,

D. L. KENNEDY,
No. 10 Cortlandt St., New York.

FEBRUARY LIST.

Second-Hand and New Tools
FOR SALE

The Tools in the following list are all of Wood, Light & Co.'s make, have been used, but are all in good order and will be sold very low:

Five Engine Lathes, 15 in. swing 6 ft. bed.
Six Engine Lathes, 20 in. swing 7½ ft bed.
Five Engine Lathes, 20 in. swing 8 ft. bed,
One Engine Lathe, 21 in swing 6 ft. bed.
One Engine Lathe, 21 in. swing 16 ft. bed
One Engine Lathe 24 in, swing 12 ft. bed,
One Engine Lathe, 28 in. swing 12 ft. bed,
Two Upright Drills, 27 in. swing, not geared.
One Upright Drill 22 in. swing, not geared.
One Upright Drill, 32 in. swing, back geared and self feed.
One Planer, 24 in. x 23 in. x 4 ft.
One Planer, 24 in. x 24 in. x 4 ft.
Two Planers, 32 in. x 30 in. x 8 ft.
One Planer, 32 in. x 30 in. x 10 ft.
One Planer, 37 in. x 37 in. x 10 ft.
One Planer, 42 in. x 36 in. x 15 ft.
One Planer, 72 in. x 66 in. x 24 ft.
One Shaping Machine, 12 in. stroke.
Four Bolt Cutters, various sizes.
One horizontal Boring Lathe.

The following are all new tools to be sold very low, and are all Wood, Light & Co.'s make.

Four Engine Lathes, 16 in. swing, 6 ft. bed.
Two Engine Lathes, 16 in. swing, 8 ft. bed.
One Engine Lathe, 20 in. swing, 20 ft. bed.
One Engine Lathe, 28 in. swing, 14 ft. bed.
Three Planers, 24 in. x 24 in x 4 ft.
Two Planers, 24 in. x 24 in. x 6 ft.
One Planer, 36 in. x 36 in. x 12 ft.
Two Shaping Machines 8 in. stroke.
Three Shaping Machines, 11 in. stroke.
One Shaping Machine, 14 in. stroke.
Two No. 1 Bolt cutters
Seven No. 2 Bolt Cutters.
One No. 1 Bolt Cutter with centers.
Five No. 2 Bolt Cutters, with centers.
One No. 1 Milling Machine.

Also the following Miscellaneous Tools:
One Portable Engine, 6 in. cylinder.
One Hand Milling Machine.
One "Pond" Index Milling Machine.
Three Chase Patent Pipe Cutting Machines.

Two Engine Lathes, 13 in swing, 6 ft. bed. Two Engine Lathes, 22 in. swing, 8 ft. bed. One Engine Lathe, 15 in. swing, 6 ft. bed. One Engine Lathe, 15 in. swing, 7 ft. bed. Three Engine Lathes, 20 in. swing, 8 ft. bed. Six Turning Lathes, 14 in. swing, 4½ ft. bed. Three 4-spindle Drills. One 8 in. Shaper. One Gear Cutter. One new "Hardaway" Bolt Heading Machine, to head up to ⅞ in. bolts. One new "Hardaway" Bolt Heading Machine to head up to 1½ in. bolts. A lot of Saw Tables and Wood Working Machinery.

Please specify which of the above tools you want and we will forward all particulars.

The above tools will be sold very low, and can be seen at

The George Place Machinery Agency,
121 Chambers and 103 Reade Sts.,
NEW YORK.

FOR SALE.
A MACHINE WORKS

In a city of this State of 100,000 inhabitants. This shop, which is one of the best known in the State, is now running, and has been for 23 years, successfully, and has made a fortune for its owner. The principal business has been manufacturing Engines, General Machinery, and a number of specialities In one specialty, which is patented, there is a fortune. The whole establishment, with buildings, can be bought for $22,000 on liberal terms. Address, for particulars, P. O. Box 226, Albany, N. Y.

ROPER'S
Practical Hand-Books for Engineers.

STEPHEN ROPER,

Mechanical Engineer.

Hand-Book of Land & Marine Engines,	$3.50
Hand-Book of the Locomotive . . .	2.50
Hand-Book of Modern Steam Fire Engines	3.50
Cathechism of Steam Engines . . .	2.00
Use and Abuse of Steam Boiler . . .	2.00

The above books embrace all branches of Steam Engineering—Stationary, Locomotive, Fire and Marine Any of them will be sent by mail, free of postage, on receipt of publication price. To any one ordering a full set, a liberal discount will be made and if on examination the purchaser does not consider them worth $50.00 the money will be refunded.

Information by letter, when asked for, will be cheerfully given to parties making inquiries about Scientific Books, Steam Engines, Boilers, Steam Pumps, Injectors, or any kind of Steam Machinery.

Address,
STEPHEN ROPER,
447 North Broad St., Philadelphia

JOHN W. HILL,

Mechanical Engineer.

DRAWINGS, OPINION AND ADVICE ON STEAM AND HYDRAULIC MACHINERY.

"EXPERT IN PATENT AND LAW CASES."

Tests and Reports made upon the performance of Steam Engines, Pumping Machinery, Boilers and Furnaces.

11 Pike's Opera House, Cincinnati.

Second-Hand Tools

One Pond's Index Miller.
One N. Y. Steam Engine Co. Miller. Very large.
One No. 2 Wood & Light Milling Machines.
Two Brainard Milling Machines, No. 3.
One Brown & Sharp Universal Miller.
Three Lincoln Pattern Milling Machines.
One Smith & Garvin No. 3. Miller. New.
Two Profile Machines.
One each 2, 3 and 4 Spindle Drills. Pratt & Whitney.
Two 4 spindle Drills.
One Small Blaisdell Drill.
One Sellers' Bolt Cutter. Cuts to 1¼ in.
One No. 2 Schlenker Bolt Cutter, new. ⅜ to ½ in.
One No. 6 Wilder Punch and Shear, new.
One No. 2 Wilder Punch Press, new.
Six Sensitive Drills, from 1-64 in. up to 5-16 in.
One Engine Lathe, 24 in. x 24 ft., nearly new. Pond.
One " " 20 in. x 12 ft., new.
One " " 18 in. x 8 ft., New Star Tool Co.
Two " " 16 in. x 5 ft., good order. Cheap.
One " " 15 in. x 5 ft. nearly new. Flather
One " " 15 in. x 4 ft., good order. Fitchburg.
One " " 12 in. x 5 ft., Ames.
One " " 12 in. x 5 ft., cheap.
One Ames "Model" Engine Lathe, 7 in. S., 38 in. Bed.
Six Fitchburg Mach. Co. Hand Lathes, 9 in. S.
Two Spencer Hand Lathes, 11 in. S., 4 ft. Bed. New
One Stewart Foot Lathe.
One Planer 38 in. x 7 ft.
One " 30 in. x 7 ft., new. Stover.
One " 27 in. x 7 ft. nearly new. Whitcomb.
One " 24 in. x 6 ft., good order. Wood & Light.
One " 24 in. x 5 ft., good order. N. Y. S. E. Co.
One Crank Planer, 24 in. stroke.
Two 8 in. Shaping Machines.
One Shaping Machine, 5 in. stroke, W. C. & Co., new.
One " " 15 in. " Hendey, new.
Two " " 24 in. " " "
One Pratt & Whitney Screw Machine. No. 1.
Two " " " " No. 2.
One Ames Jigging Machine.
28 in. x 60 in., Corliss Hor. Engine.
32 in. x 72 in., " Beam Engine.
18 in. x 42 in., Hewes & Phillips' Hor. Engine.
18 in. x 36 in., Fishkill Landing Mach. Co. Engine.
16 in. x 48 in., Double Valve Hor. Engine.
16 in. x 42 in., Norwalk Hor. Engine.
16 in. x 42 in., Greene Cut-off Hor. Engine.
16 in. x 40 in., Ames Hor. Engine.
14x 30 " Adj. Cut-off Valve Engine, Whitehill & Smith.
10 x 24 " Fishkill Landing Engine.
10 x 24 " Harris Corliss Valve Engine, new.
Two 10 H. P. Baxter Engine.
One 6 " " "
One 4 " N.Y. Safety Power Co. Engine.
One 40 " " " Hor. Boiler.
One 25 " Vertical Hor. Boiler
One No. 1 Root Blower.
Lot of Belting, Parker Vises, Shafting, Pulleys and Hangers.

E. P. BULLARD,
14 Dey Street, New York.

Worcester Boiler Works,

MANUFACTURERS OF THE

"VICTOR"

Feed-Water-Heater and Purifier,

FOR

HEATING AND PURIFYING WATER

FOR STEAM BOILERS.

(Jones' Patent, Nov. 6, 1877.)

WM. ALLEN & SONS
WORCESTER, MASS.

☞ Writ for prices and further information.

H. PRENTISS AND COMPANY

Manufacturers of GODDARD'S PATENT RELIEVED

Machinists', Blacksmiths' and Gas Fitters'

Taps, Dies, Reamers & Screw Plates.

New York Agency for Reynolds & Co.'s Machine Screws. Stub's Pol. Steel Wire. Mild Tempered and Music Wire a Specialty. Headquarters for the Goddard Emery Wheel, Billings & Spencer Co.'s Goods, Burbidge's Patent Tweer Iron, the Victor Chuck and Micrometer Caliper, and Henry Whiton's Chucks.

No. 14 DEY STREET, - NEW YORK.

NEWARK

Steel Works.

BENJAMIN ATHA & CO.

Manufacturers of

CAST STEEL.

We make grades of Steel specially adapted to the manufacture of Lathe Tools, Chisels, Taps and Dies.

NEWARK,

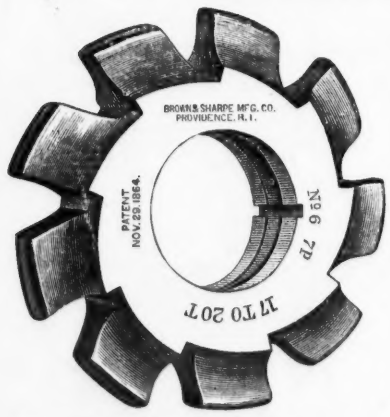
NEW JERSEY.

BENJ. ATHA. J. ILLINGWORTH.

BROWN & SHARPE MFG. CO.

Providence, R. I.

MANUFACTURERS OF



MACHINERY AND TOOLS.

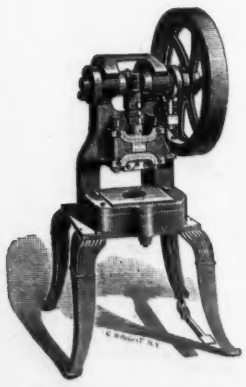
Gears Cut and Index Plates Made and Drilled to Order.

PATENT CUTTERS FOR THE TEETH OF

GEAR WHEELS

can be sharpened by grinding without changing their form. Cutters made on this plan will outlast many of the old form, with the advantage of being always ready for use. If the cutter becomes dull before a wheel is completed, it can be taken out, sharpened and returned to its place in a few moments without risk of altering the form of teeth to be cut. Cutters for milling any irregular form made to order on the same plan. Parties having occasion to use mills for irregular shapes on sewing-machine, gun or other work, will readily see the advantage such cutters possess over those in general use, both as regard economy and convenience. Prices reduced. Our new Illustrated Catalogue sent per mail on application.

GOLD MEDAL AWARDED PARIS EXPOSITION, 1878.



BLISS & WILLIAMS,

MANUFACTURERS OF ALL KINDS OF

Presses, Dies and Special Machinery

FOR WORKING SHEET METALS, &c.

FRUIT AND OTHER CAN TOOLS.

167 to 173 Plymouth St., cor. Jay, Brooklyn, N. Y.

Catalogues in English, French and German sent on application, in which prices are computed in Dollars, Pounds, Francs and Reichsmarks.

THE PRATT & WHITNEY CO.

HARTFORD, CONN., U. S. A.

MAKE SPECIALTIES OF

Drop Hammers,

PUNCHING PRESSES,

HAND DRILLING MACHINES, RATCHET DRILLS, COMBINATION LATHE CHUCKS, CUTTERS FOR TEETH OF GEAR WHEELS, SCREW PLATES, HAND, MACHINE NUT AND PIPE TAPS, AND BOLT CUTTERS,

in connection with their business of MACHINISTS' TOOLS, GUN, SEWING MACHINE, and Special Machinery, &c.

PRICE LISTS FURNISHED ON APPLICATION.

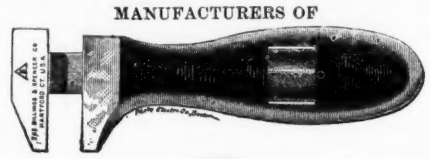
THE BILLINGS & SPENCER CO.

CHAS. E. BILLINGS, Pres't and Sup't. TRADE B MARK. E. H. STOCKER, Secretary.
L. H. HOLT, Treasurer.

HARTFORD, CONN., U. S. A.

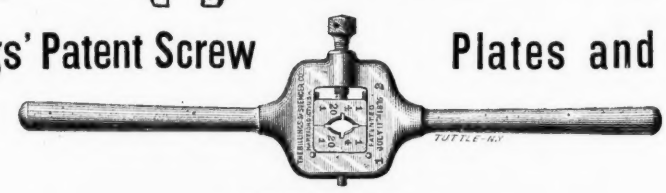
MANUFACTURERS OF

Billings' Adjustable



Pocket Wrench.

Billings' Patent Screw



Plates and Dies.

Billings' Adjustable Tap & Reamer Wrenches,

WROUGHT IRON AND STEEL, DROP FORGED LATHE DOGS, SCREW DRIVERS, AND SOLID FORGED SEWING MACHINE SHUTTLES. Also, PACKER RATCHET DRILLS, BARWICK WRENCHES, &c., and all descriptions of

STEEL AND IRON DROP FORGINGS

For Guns, Pistols, Sewing Machines, Machinists' Tools and Machinery Generally. Send for illustrated Catalogue and Price List.

Manufacturer of **TAPS AND DIES** of every description.

Also, for sale low, **UNITED STATES STANDARD GAUGES**, from ¼ to 3 inch.

Pond's Tools,

Engine Lathes, Planers, Drills, Etc.

DAVID W. POND,

Worcester, Mass.

☞ Send for Catalogue.

SCHLENKER'S

STATIONARY-DIE AND REVOLVING-DIE

BOLT CUTTERS

THE BEST AND CHEAPEST MADE.

HOWARD IRON WORKS,

☞ Send for Catalogue. Buffalo, N. Y.

A. J. WILKINSON & CO.

184 Washington Street,

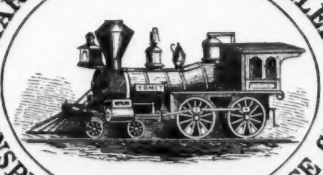
BOSTON.

Machinists' Hardware, Supplies,

AND SMALL TOOLS.

Catalogues sent free on application.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.



J. M. ALLEN, PRESIDENT.
W. B. FRANKLIN, VICE-PRESIDENT.
J. B. PIERCE, SECRETARY.

CHROME STEEL,

Warehouse, 98 William St., New York.
JOHN W. QUINCY, Manager.

This Cast Steel is unequaled for strength, durability, and uniformity. Please send for a circular for evidence that it is the most economical to use and that it will do 50 per cent. more work than any other.